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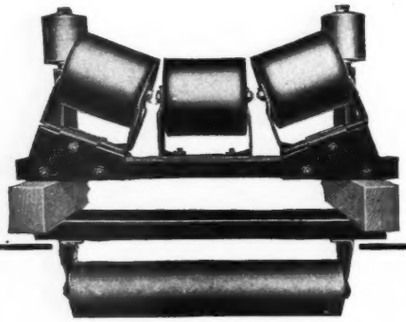

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Mining Journal

VOLUME 101 JUNE 17, 1916 NUMBER 25

Lübecker Excavator in the Klondike

By C. A. Thomas*

SYNOPSIS—A Lübecker excavator erected on Dominion Creek, Yukon Territory, is to be tried this season by the North West Corporation, Ltd. This chain-bucket excavator is of a type used in digging brown coal in Germany, but has been specially designed to withstand the severe duties involved in digging the Klondike gravels. The outcome will be watched with interest by operators of gold dredges which this machine is designed to replace.

During the summer of 1915 the North West Corporation, Ltd., erected a chain-bucket excavator on Dominion Creek, in the Klondike mining district, Yukon Territory, Canada. The construction work was completed too late in the fall for a trial run, and the demonstration of this machine as a placer-digging and washing plant will not be made until the ground has thawed to such depth as to allow excavation of the gravel without the added cost of artificial thawing.

This English corporation owns or controls a great many miles of low-grade creek and river claims on the Indian River watershed, and has been experimenting for several years on the removal of frozen muck overburden, which, acting as an insulating blanket, keeps the underlying gravel frozen the year around. Where the gravel is not naturally thawed, it is necessary to thaw by means of steam before excavation is possible. The method adopted by this company for removing overburden is locally known as ground sluicing, assisted by water under pressure, and has been fully described[1] by E. E. McCarthy. Many miles of ditches have been constructed along Dominion Creek, and during the last three years between three and four million yards of muck have been moved.

Excavator as Substitute for Dredge

Nearly all the mining companies operating on a large scale in the Klondike on creek or river gravels are using the ordinary type of floating dredge; but the North West Corporation, Ltd., decided to try a well-known German type of excavating machine,[2] remodeled and strengthened to withstand the severe conditions of gravel digging, and has fitted this excavator with a washing plant and stacker for handling the coarse tailings. The excavator was constructed by Taylor & Hubbard, Leicester, England, and is designated as "Chain Elevator No. 11," while the washing-plant and stacker machinery was built by Leach & Goodall, of Leeds. The whole machine, weighing approximately 170 tons, is self-contained and is designed to operate on two sets of tracks of 39½-in. gage, the outside rails of these tracks being about 23½ ft. apart.

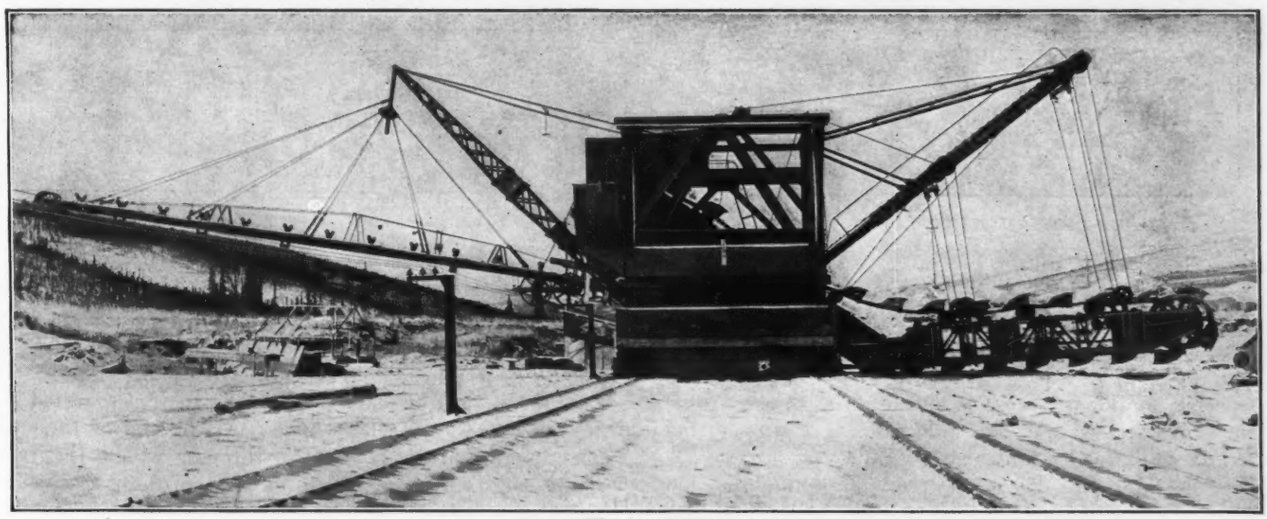


FIG. 1. LÜBECKER EXCAVATOR ERECTED ON DOMINION CREEK, YUKON TERRITORY

The excavator consists of a 16-wheel carriage, made of two longitudinal steel box girders, 36 ft. 6 in. long, spaced 18 ft. apart, carrying the steel frame of the machine. This frame is composed principally of 12-in.

*Resident manager, Yukon Gold Co., Dawson, Y. T., Canada.

[1] "Min. Mag.," April, 1914.

[2] Made by the Lübecker Machinenbau Gesellschaft, Lübeck, Germany; described by George J. Young, "Brown-Coal Mining in Germany," Bull. A. I. M. E., February, 1916.

channels and I-beams, having approximately the following over-all dimensions: 27 ft. long, 22 ft. wide and 27 ft. 4 in. high.

The machine is carried on four trucks of four wheels each. Each truck has two flanged wheels on the outer side and two flat-surfaced wheels on the inner. The two flat-surfaced wheels on the port trucks are used as driving wheels, the power being transmitted from the motor by means of a set of bevel gears.

The speed of the machine, traveling parallel to the opencut, can vary from 3 to 10 ft. per min., and will be determined by the depth to which the buckets are digging at any time.

The upper tumbler, which drives the bucket line, is geared direct to a 100-hp. motor. This tumbler is six-sided—three flat and three having projecting cast lugs which, as the tumbler revolves, enter the open spaces in the connecting bucket links, propelling the line in the desired direction. The lower tumbler consists of two round cast flanged wheels 64 in. in diameter, spaced 48 in. apart and tied together on the lower tumbler shaft with 1-in. iron rods. The intermediate tumbler consists of two round cast flanged wheels, 45 in. in diameter, spaced 48 in. apart. The bucket line passes from the movable ladder over this idler to the stationary-ladder frame built into the excavator frame.

The digging ladder is built up of light plates, angles and channels; length between lower and intermediate tumbler, approximately 31½ ft.; inside dimension, 49x54 in. It is designed to dig 25 ft. below the track as well as 25 ft. above, at angles of 45° from horizontal. The digging ladder is suspended from the intermediate tumbler shaft.

Buckets Are Open-Connected and Are Filled When Traveling Toward the Machine

The buckets are open-connected, made up of riveted sheet steel, with cast-steel cutting lip. They are connected by means of "Jackmanized" steel links and pins, a cast-steel lug riveted to the sides of the bucket forming one of the links of the chin. These lugs and connecting links, traveling in a channel on the under side of the ladder, keep the buckets down against the material to be excavated and take the entire digging strain when the machine is operating. The buckets are spaced approximately at 4 ft. 9 in. centers; links are 14 in. to the center of pins. The solid links are 3½x1½ in., while the links that form the opening for the upper-tumbler driving lug are ⅞x1½ in.

The buckets are filled as the line travels toward the machine on the lower side of the ladder, which is the reverse of the ordinary dredge operation. After passing over the intermediate tumbler, the full bucket line travels up a sheet-steel chute, being held about 3 in. from the bottom by cast lugs on the sides of the chute. At the same time that the buckets are being filled, the whole machine will be propelled along its two sets of tracks, corresponding to the swing of the floating dredge.

As the line passes over the upper tumbler, the rear of the bucket disengaging from the connecting chain, allows its contents to slide out the back end into the dump hopper. Before the bucket passes over the top of the upper tumbler, it is in an upside-down position over the hopper. The empty line returns to the lower tumbler in suspension or carried on light flanged-wheel idlers.

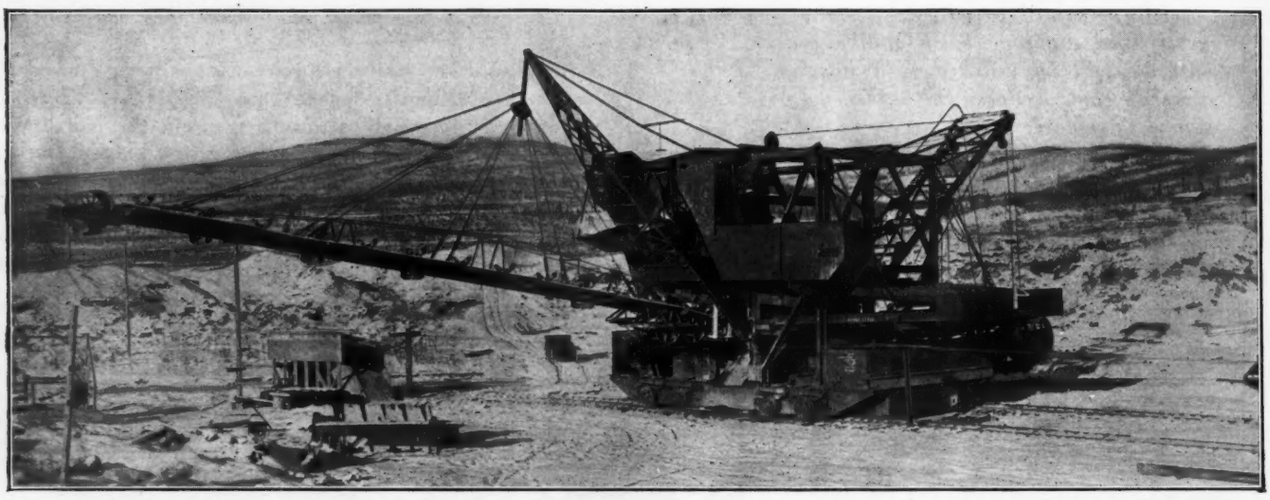


FIG. 2. STERN VIEW, LÜBECKER EXCAVATOR, SHOWING HOPPER, WASHING PLANT AND STACKER; ALSO, SETTLING TANKS UNDER TABLES

As the gravel is dumped into the hopper, it is dragged to the starboard side of the machine by an endless raker chain composed of cast links and crossbars, supported and driven by cast sprocket wheels. At the end of the steel-plate compartment (Fig. 2) through which the raker chain carries the material to be washed, there is an opening that allows all material to drop to a second compartment immediately below; and the same chain returning, after passing over the sprocket idler, drags the material over a set of grizzly bars, approximately 20 ft. long. Two 8-in. spray pipes, extending the full length of this compartment, furnish the water for washing and separating the fines and gold from the coarse material. This operation is to do away with the revolving or shaking screens of other types of placer-mining machines. The fines, after passing through the grizzly, are carried by steel sluices to the gold-saving tables. The coarse material is dragged by the crossbars of the raker chain past the grizzly-bar ends, where it falls into a metal chute and is conveyed by gravity to the stacker.

The tables are constructed in two 20-ft. sections of six sluices each, having a fall of 1½ ft. in 20-ft. and a total area of about 720 sq.ft. After the water and fines have

passed over the last section, they are collected in a steel sluice and carried across the machine to the sand-elevator settling tank (Fig. 4) on the port side of the excavator. This settling tank is 54 in. by 27 ft. 7 in., with bottom sloping to the center, making a sump for the collection of sand for elevation by a bucket conveyor. These buckets elevate the sand to the top of the machine, where it is dumped into an extension of the steel chute that delivers the coarse material to the stacker. The water from the sand-elevator tank is conveyed across the machine to a series of steel settling tanks under the tables. From these tanks the water is repumped to the spray pipes over the grizzly bars, and in this way will be used over and over for washing the gravel.

The capacity of the water tanks on the machine represents the total amount of water that can be utilized for washing and is as follows: Settling tanks, 8,070 U. S. gal.; sand-elevator tank, 3,831; total, 11,901 gal. It is proposed to replenish these tanks with fresh water at the end of each cut, but if this method does not furnish sufficient water to disintegrate and wash the gravel, then a series of hydrants will be installed at the rear of the excavator and water taken aboard as required while the machine is in motion.

The stacker is 70 ft. in length, equipped with a 24-in. canvas conveyor belt, and as at present constructed, cannot be lowered or elevated. The discharge end of stacker is about 20 ft. above the level of the rails.

The bucket line is driven by a 100-hp. motor through an intermediate shaft. On this shaft is arranged a friction clutch that can be set so that the pinion will be automatically released if the strain becomes too great for the bucket line. The ladder hoist is driven by a 30-hp. motor. This motor is also geared to the drive wheels that propel the machine. The 12-in. water pump is direct-connected to a 50-hp. motor. The raker-chain, stacker and sand-elevator drives are all taken from a countershaft connected to a 30-hp. motor. The electrical equipment was manufactured by the British Thomson-Houston Co., Ltd.

Power will be furnished by the North Fork Power Co. from the North Fork of the Klondike River, 19 mi. from the present site of the excavator on Dominion Creek. The transmission line will deliver current at a voltage of 33,000, which will be reduced to 220, the voltage required by the electrical equipment on the excavator.

The machine has been constructed on one of the areas stripped of muck. At first a cut will be excavated down to bedrock and parallel to the track. When the cut is completed, the track will be shifted to the rear and a second cut taken out. Before the tailings deposited by the stacker will interfere with the machine, it is expected that a cut of sufficient area will have been opened to allow the free operation of the machine on bedrock. After the excavator has been moved down on bedrock, digging will be done above the tracks, the ladder extending upward.

The constructors of this excavator expect it to prove superior to the ordinary dredge, giving the following as some of the reasons: (1) Smaller initial cost and capital expenditure; (2) lower cost of operation; (3) elimination of artificial thawing; (4) exposing bedrock to view; (5) making it possible to clean bedrock by hand if desired; (6) raising percentage of extraction.

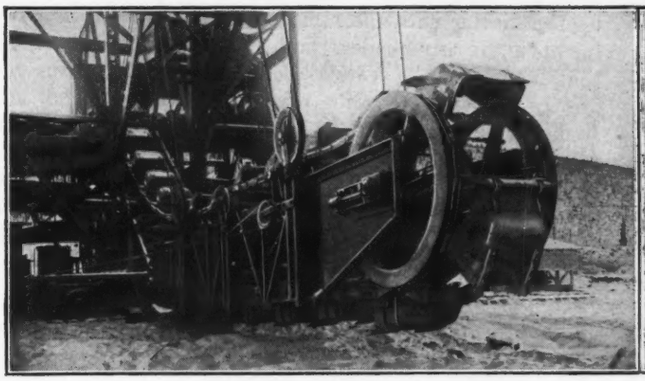


FIG. 3. DIGGING LADDER, BUCKET LINE AND LOWER TUMBLER

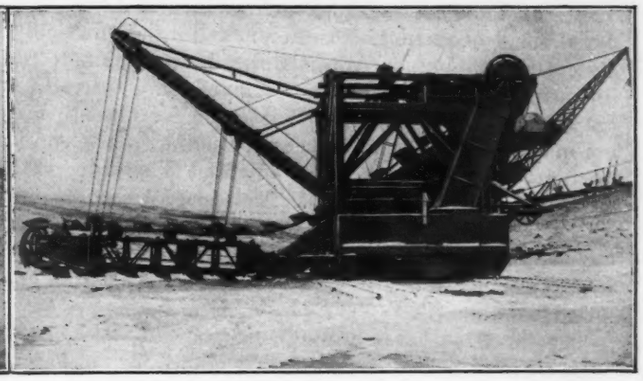


FIG. 4. PORT VIEW; NOTE SAND ELEVATOR AND SETTLING TANK

Villa Duties on Zinc Ore from Mexico

Special taxes imposed by Villa, the Mexican bandit, on Mexican zinc ore intended for shipment into the United States do not become dutiable charges on the merchandise under a ruling made by President Sullivan, of the Board of General Appraisers, sitting as a reappraisement official, says the New York *Times*.

It appeared from the papers and testimony in the case that the ore in question was shipped to this country by J. del Riogo, of Juarez, being entered at St. Louis Aug. 28, 1915. Before the ore was allowed to leave Chihuahua, the so-called Mexican government represented by Villa exacted a duty of $45.36 American currency on the ore. In making entry at St. Louis, the importers deducted this charge from the dutiable value.

The St. Louis appraiser disallowed the deduction, added it to the remaining market value, and assessed duty. No question arose as to the value of the ore itself. An appeal was taken for a review of this Custom House action. Judge Sullivan said that it was shown beyond all question that the Mexican duty in question was exacted on all merchandise exported from that portion of Mexico under the control of Villa. Another point brought out was that the tax was not part of the market price of the merchandise in Mexico.

"In my opinion," said the general appraiser, "it stands on the same footing as switching and freight charges, deducted on entry, and nondutiable. The *per se* value of the merchandise is not in controversy. This duty should be deducted on entry." The appraiser's action in adding the tax for dutiable purposes was reversed.

Iron-Ore Production in 1915

The iron-ore production of the United States in 1915 reached a total of 55,526,490 tons, according to the figures collected for the United States Geological Survey and prepared by E. F. Burchard. This was an increase of about 14,000,000 tons over 1914 and was a larger production than in any previous year except 1910 and 1913. The average value at mine, as computed by the Survey, was $1.83 per ton in 1915, against $1.81 in 1914. The production by states for the two years is shown in the accompanying table.

IRON ORE MINED IN THE UNITED STATES IN 1914 AND 1915.
(In Long Tons)

State	1914	1915	Changes
Minnesota	21,946,901	33,464,660	I. 11,517,559
Michigan	10,796,200	12,514,516	I. 1,718,316
Alabama	4,838,959	5,309,354	I. 470,395
Wisconsin	886,512	1,095,388	I. 208,876
New York	785,377	998,845	I. 203,468
Wyoming	366,962	434,513	I. 67,551
New Jersey	350,135	415,234	I. 65,099
Pennsylvania	406,326	363,309	D. 43,019
Virginia	378,520	348,042	D. 30,478
Tennessee	330,214	284,185	D. 46,029
Georgia	67,722	115,701	I. 47,979
North Carolina	57,667	66,453	I. 8,786
Missouri	37,554	40,290	I. 2,736
New Mexico	81,980	34,806	D. 47,174
Other States	108,732	41,194	D. 67,538
Total	41,439,761	55,526,490	I. 14,086,729

The "other states," in which small quantities were mined included California, Colorado, Connecticut, Idaho, Kentucky, Massachusetts, Mississippi, Montana, Nevada, Ohio, Utah and West Virginia. None of these states is credited with more than a few thousand tons.

Iron ore was mined in 27 states in 1914 and 23 in 1915. Three of these states—Idaho, Nevada and Utah—produced small quantities of ore for metallurgical flux only; part of the production from California and Colorado was for smelting flux and part for pig iron and ferroalloys: the remaining states produced iron ore for blast-furnace use only, except small tonnages for paint from Georgia, Michigan, New York, Pennsylvania and Wisconsin. Five states—Minnesota, Michigan, Alabama, Wisconsin and New York—which have in recent years produced the largest quantities of iron ore occupy in 1915 their accustomed places. Only one of these, New York, produced less than 1,000,000 tons in 1915

The principal iron-mining districts in the United States, except the Adirondack district, are interstate, and statistics of production by districts are of more interest and importance than statistics by states. The Lake Superior district mined nearly 85% of the total ore in 1915 and the Birmingham district about 8.5%, or a little more than one-tenth as much as the Lake district. None of the other districts mined as much as 1,000,000 tons. The increase in production in 1915 was especially marked in the Lake Superior district, where it reached 40%. The Adirondack and Chattanooga districts each showed a large increase.

The figures given for the Lake Superior district in this report differ somewhat from those officially supplied by the mining and transportation companies, the totals of which were published in the *Journal* of Apr. 1. This difference is partly due to the exclusion by the Geological Survey of the Baraboo Range and some other Wisconsin mines.

There were seven mines that produced more than 1,000,000 tons of iron ore each in 1915, two more than in 1914. First place in 1915 was held by the Mahoning at Hibbing, Minn., second place by Hull-Rust at the same place, and third place by the Red Mountain group near Bessemer, Ala. The production of these mines in 1915 was respectively 2,311,940 tons, 2,307,195 tons and 2,138,015 tons.

The apparent consumption of iron ore, obtained by adding together the shipments of ore from the mines, the sales of zinc residuum and the imports of iron ore, and deducting from the sum of these the exports of iron ore, was 56,286,058 gross tons in 1915, compared with 40,613,448 gross tons in 1914, an increase of nearly 39%. The ratio of pig iron produced to iron ore consumed was 53.15% in 1915, compared with 57.45% in 1914.

This does not take into account the consumption of iron ore in openhearth furnaces and rolling mills, which amounts to about 900,000 tons yearly. This is partly offset by the use of mill cinder, pyrites residue, etc., in the blast furnaces.

Honorary Members of the A. I. M. E.

The American Institute of Mining Engineers is desirous of having a complete set of photographs of its honorary members in order that these may be hung in the Members' Room. A letter has been sent to all the living honorary members of whom the Institute has not portraits, asking for a photograph.

Appended hereto is a list of the deceased honorary members of the Institute. If any reader of the *Journal* can assist the Institute in obtaining photographs of them, their aid will be appreciated greatly. We suggest taking up the matter with the families of the deceased honorary members, if any readers happen to know them, or else that they write the secretary of the Institute, letting him know the names of some of their intimate friends now living or members of their families, in order that he may take up the matter.

Three years of effort have at last enabled the Institute to get a complete set of photographs of past presidents and it now hopes to be equally successful with photographs of its honorary members.

HONORARY MEMBERS (DECEASED)

Year of Election		Year of Decease
1872.	Bell, Sir Lowthian*	1904
1892.	Castillo, A. Del	1895
1902.	Contreras, Manuel Maria	1902
1888.	Daubrée, A.	1896
1884.	Drown, Thomas M.*	1904
1890.	Gaetzschmann, Moritz	1895
1873.	Gruner, L.	1883
1891.	Kerl, Bruno	1905
1895.	Le Conte, Joseph	1901
1891.	Lesley, J. P.	1896
1899.	Osmond, Floris	1912
1890.	Patera, Adolph	1890
1886.	Percy, John*	1889
1888.	Posepny, Franz	1895
1884.	Richter, Theodor	1898
1899.	Roberts-Austen, W. C.	1902
1890.	Serlo, Albert	1898
1880.	Siemens, C. William	1883
1909.	Swank, James M.	1914
1872.	Thomas, David*	1882
1873.	Tunner, Peter R. Von	1897
1885.	Wedding, Hermann	1908

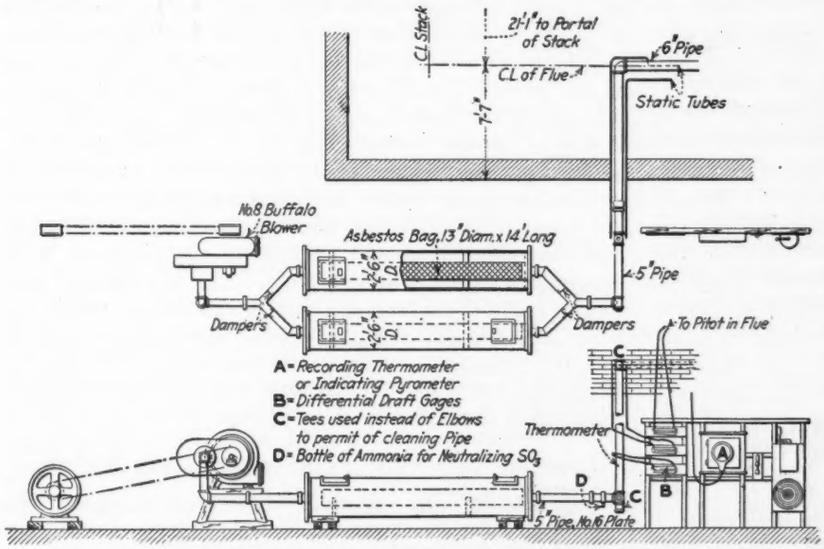
In the cases of the names marked by asterisk photographs are already possessed.

Mineral Resources of Taiwan (Formosa), according to a report from U. S. Consul, H. C. Huggins, are not extensive. There are lands now in the possession of the savage tribes that are supposed to be rich in minerals, but these lands have not yet been completely explored. The total value of mineral products in 1914 was $2,264,528, of which the two gold-quartz mines yielded $910,360, the 345 coal mines $652,942. and the copper mine $525,774. The production of petroleum was expected to be very great, but the reality has not come up to expectation. The quality of the oil is very poor.

Methods of Measuring Dust Losses at Copper Queen Works*

SYNOPSIS—The methods employed for determining the dust losses at the Copper Queen reduction works, Douglas, Ariz., are described and the various formulas used discussed. Velocity of stack gases measured by pitot tubes, but flue velocity was too low for safe determination with this apparatus and the static-balance method was used. Gases filtered through asbestos fabric, which is satisfactory for all smelting gases, flannel being satisfactory only for blast-furnace and converter gases but not for roaster gases.

Prior to 1909 the determination of dust losses at the Copper Queen smelting works at Douglas, Ariz., had not been studied much and estimates of dust losses, with a few exceptions, were the results of tests by what has been termed "chemical methods"; that is, the aspiration and filtration through cotton, wool or some similar medium of a few liters of gas, the dust being weighed on a chemical balance, and the volume of gas computed from the volume of aspirator water. The possible error of this method is enormous and the probable error much too large for reliable results. Since the object of the tests was to discover not only the extent of the dust losses, but also the possibility of profitably reducing them, it was decided that the method adopted must have the following characteristics:


CL Stack
21'-1" to Portal of Stack
6" Pipe
CL of Flue
Static Tubes
No.8 Buffalo Blower
Asbestos Bag, 13' Diam. x 14' Long
5" Pipe
Dampers
Dampers
To Pitot in Flue
A = Recording Thermometer or Indicating Pyrometer
B = Differential Draft Gages
C = Tees used instead of Elbows to permit of cleaning Pipe
D = Bottle of Ammonia for Neutralizing SO_3
Thermometer
5" Pipe, No.16 Plate

APPARATUS USED AT COPPER QUEEN WORKS FOR DETERMINATION OF DUST LOSSES

1. The sample of gas taken for filtration must be representative of the whole volume of gas; that is to say, it must have the same dust content. This condition will be fulfilled in all cases if the gas sample is drawn off without change of rate of flow. Then it will contain the same proportion of entrained or suspended particles of dust as the original gas. In the case of flue gases which contain only fume at a temperature above or near the sublimation point, this condition need not be adhered to since the fume will not behave as entrained particles, but more nearly as a true gas. Consequently the gas sample in this case only may be drawn off at any rate of flow.

2. The gas sample taken must be large enough (a) to yield sufficient dust to permit of accurate chemical and physical examination; (b) so that the ratio of the total volume of gas passing through the flue to the volume of gas sample taken, shall not be too large.

3. The methods of measurement of gas volumes should be such that an occasional independent check can be made.

The dust-loss determinations so far made at the Copper Queen smelting plant fall under two heads: (1) Determination of stack losses. Here gas velocities are relatively high and may be measured with accuracy by pitot tubes. (2) Determinations of the loss from one department made by measuring the amount of dust passing a certain point in the flue, deducting the dust collected in the remainder of the flue. The gas velocity in most of these cases was too low to permit of measurement by pitot tubes, and so the static-balance method of sampling had to be adopted. Velocity head is measured by pitot tubes of the form recommended by W. C. Rowse,[1] and Ellison differential-draft gages, using petrolic ether instead of the gage oil supplied. The former has the advantage of being less viscous and also lighter, but in the summer in Arizona it is necessary to shade the gage carefully, as evaporation of the ether would otherwise be too rapid. Atmospheric pressure is determined by a standard mercury barometer and flue temperatures by a Bristol (indicating) pyrometer or a Bristol recording thermometer. For the temperatures of the gas sample, a 600° F. mercury thermometer is used. In order to convert velocity head from inches of water into feet of gas, it is necessary to know the specific gravity of the gas. This is computed from the analysis of the gas. Sulphur trioxide, sulphur dioxide and carbon dioxide are determined together: SO_3 by the Hawley method;[2] SO_2 by absorption in a measured volume of a standard solution of Na_2CO_3 in the presence of excess H_2O_2; and CO_2 gravimetrically. In addition, oxygen and water vapor are determined, the remainder being taken as nitrogen. It is found in practice that the specific gravity of all the gases, at points used for dust-loss determinations, closely approximates 4% heavier than air. However, this was not taken for granted, and the precaution was taken of making specific-gravity determinations before each test.

*Excerpts from a paper, "Determinations of Dust Losses at the Copper Queen Reduction Works," by J. Moore Samuel, testing engineer, to be read at the Arizona meeting of the American Institute of Mining Engineers, September, 1916.

[1] "Trans. A. S. M. E.," Vol. 35, p. 643 (1913).

[2] "Eng. and Min. Journ.," Vol. 94, p. 987 (Nov. 23, 1912).

The apparatus used in the first series of tests was as follows: An 8-in. pipe was placed outside of the steel stack from the top to the base. The upper end of the pipe was extended to a point inside the stack, 7 ft. below the top. The suction intake was varied by swinging in the arc of a circle having a radius of 8 ft. 9 in., the stack radius being 11 ft. 6 in. The first series of tests was made at five different points, but since no appreciable difference in dust loss could be found, subsequent tests have been made with the suction intake in its most extended position, 3 ft. 9 in. from the center of the stack. The 8-in. pipe was connected to a No. 4 Sturtevant fan which was driven by a 5-hp. variable-speed motor. The fan discharged through an 8-in. diameter flexible connection into a 4-ft. diameter vertical drum of boiler plate. The outlet at the top of this was a 12-in. nipple, to which was wired a bag 28 in. in diameter by about 20 ft. long made of closely woven flannel. The top of this bag was closed by a cord, the end of which passed over a pulley. This afforded a means of shaking the dust out of the bag into the drum. The bag was housed in a wooden structure. A set of pitot tubes was placed 5 ft. inside the stack, 90 ft. above the base of the stack, the temperature of the gas being measured at the same point by a Bristol recording thermometer. Another set of pitot tubes and a mercury thermometer in the 8-in. pipe were used to measure the gas sample.

Formulas Used in Measuring Gas Velocities

The basic formula $v = \sqrt{2gh}$ gives v the velocity of the gas in feet per second, if g the acceleration due to gravity is in feet per second and h the velocity head is in feet of gas at the temperature and pressure of the gas. Now if P is the reading of the differential-draft gage in inches of water giving difference between pressure in dynamic and static pitot tubes, T the temperature of the gas expressed in the absolute scale, SW the specific gravity of water at the temperature of the gage and Sg the specific gravity of the gas at a temperature T, then

$$Velocity\ head = \frac{SW}{Sg} \times \frac{P}{12}$$

Since the pressure of the gas is constant, its specific gravity varies inversely as the absolute temperature. Hence h is proportional to PT and $v = k_1\sqrt{PT}$, K_1 being a constant. Now if W is the weight of gas that passes a cross-sectional area of 1 sq.ft. in 1 sec., then

$$W = v \times Sg = k_1\sqrt{PT} \times \frac{K_2}{T} = K\sqrt{\frac{P}{T}}$$

In order to obtain the same weight of gas per square foot per second in both stack and pipe (which insured having the same velocity of gas in stack and suction intake), it was only necessary to run the motor at such a speed that the quotient of P divided by T was the same for both stack and pipe readings.

Given the velocity and specific gravity of the gases, it is obvious that volumes and weights of gas can be easily computed. The volume of the gas sample, however, will be high if taken as the product of this velocity by the area of the sample pipe, owing to the fact that the center velocity is higher than the average. Readings should be taken along a diameter at the centers of annular rings of equal area and the average computed from them. This gives a factor for correcting center readings. This factor should be determined for several different velocities, as it depends on the velocity of the gas and the size and nature of the pipe. The early tests were not corrected in this way; in subsequent tests this correction was made. After running the fan at the correct speed for a number of hours, the dust collected was cleaned up, weighed, sampled and assayed, and the dust and metal losses computed.

Gases Filtered Through Asbestos Fabric

The method at present used, where high gas velocities are encountered, is the same in principle and is shown diagrammatically. The measurements are made in the same way, but the gas sample goes through the filter under suction instead of under pressure, and the filter is made of asbestos fabric instead of flannel. A large fan is used on account of the increased head required to pull the gas through the heavy asbestos fabric. This bag is weighed before and after the run and the dust brushed out of it. The dust will contain some asbestos, but this may be removed by screening through a coarse sieve.

This method has several advantages: When filtering the gas under pressure any leaky place between the fan and the filter will result in the escape of gas carrying its dust with it; but when filtering under suction, slight leaks do not matter, since they only allow outside air to be admitted. Measurements of the gas are made in front of the filter, in the pipe, which can easily be made air-tight. So a correct measurement of the gas sample is obtained with the certainty that all of it goes through the filter.

The asbestos fabric has the advantage over flannel that it can be used for all smeltery gases. Flannel was satisfactory for the blast-furnace and converter gases, but was destroyed almost immediately by the roaster gases, on account of their higher SO_3 content; for the first series of determinations of roaster loss, it is true, flannel was used, but it was necessary to put ammonia in the path of the gas and that resulted in the dust being contaminated with ammonium sulphate and sulphite. The net effect of this was to make the screen analyses of dust of no value. A filter of 200-mesh phosphor-bronze screen was tried; it was not affected by the gases chemically and filtered efficiently, but it had no strength, and the expansion and contraction disrupted it quickly.

Low Gas Velocities by Static-Balance Method

Gas velocities in the stack were high enough to be measured readily by pitot tubes. To determine the dust loss from any one department, measurements had to be taken in the flues where the velocity was such as to give a just-measurable velocity head. Accordingly, pitot tubes were used in conjunction with a sensitive Ellison gage as one method of gas determination, but more reliance was placed in the measurement of flue-gas velocity by the static-balance method. Two static tubes are placed, one inside the sample pipe and the other in communication with the flue only, and they are connected to a differential draft gage. By adjusting the speed of the motor so that zero reading is obtained on this gage, the gas flows into the suction intake at the same velocity as in the flue, around or near the sample pipe. Outside the flue the gas travels through a pipe of smaller diameter than the suction intake. This results in a magnification of the velocity in the ratio of the areas of the pipes and permits of accurate velocity measurements.

If v is the velocity of the gas in this smaller pipe, T is its temperature, T_1 is the temperature of the flue gases,

both temperatures being in the absolute scale, and if D is the diameter of the suction intake, d the diameter of the smaller pipe, then the velocity of the flue gases around the sample pipe equals

$$v \times \frac{d^2}{D^2} \times \frac{T_1}{T}$$

In using this method the piping is arranged so as to measure a velocity of between 30 and 40 ft. per sec. The volume of the gas sample, indicated by the pitot tube in the small pipe, gives a measure of the velocity of the gas at the suction intake; it is only in rare cases that the rate of flow of the gas will be uniform over the whole cross-sectional area of the flue. In order to compute the volume V of gas flowing through the flue, it is necessary to obtain a factor to convert this velocity into volume. The free cross-sectional area of the flue is first determined by taking soundings of the dust line at a number of points across the flue. These can then be plotted and the area determined with a planimeter. If v is the velocity of the gas at the sample point, A the free cross-sectional area of the flue, then

$$V = KAv$$

K the constant being the ratio of the average velocity of the gases over the whole flue to the velocity at the suction intake. Two methods have been used to determine K. The most direct method is to make a careful exploration of the flue with two sets of pitot tubes, one being kept at the position of the suction intake and the other moved to a series of points across the flue. The cross-section of the flue is divided into a number of equal areas and these readings taken at the centers of such areas. From these readings, the volume of flue gases is computed and the factor K obtained and used in the dust-loss tests.

Checking Pitot-Tube Readings

The other method of determining K can be used where gas velocities are too low for pitot-tube readings, or as a check in pitot work. Velocity readings with pitot tubes are taken at some point in the system where the cross-sectional area of the conduit is a minimum, a sufficient number being taken to give a fair average. Simultaneous gas samples are then taken at this point and in the flue for which K is to be determined, and these gas samples are analyzed for one or more constituents such as SO_2, CO_2 or O. Since the volume of gas passing the first point is known, and the simultaneous gas analyses give the percentage of excess air admitted into the system between two points, the volume at the second point can be obtained from these and a comparison of the gas temperatures at the two points.

The exploration of the roaster flues showed great variation in gas velocity across the flue. From this it was inferred that the filtration of a gas sample from any one point would give a dust loss that was too high or too low according to whether the suction intake was in a zone of high or low velocity. Accordingly, it was decided to make small-scale tests to give the comparative dust content of the gases in different parts of the flue. These were referred to the suction intake of the large-scale tests. The apparatus used for this was developed by the engineers of the Western Precipitation Co. and has been described by W. N. Drew.[3] Briefly it consists of a small suction intake with two statics as in the large-scale work. At Douglas ¼-in. and ⅜-in. pipe was used. The gas was filtered through a weighed fat-extraction thimble, was drawn out by aspirator, and the rate of flow adjusted to zero on a differential draft gage connecting the two statistics. Velocities were computed from the volume of water drawn from the aspirator, corrected to temperature and pressure conditions in the flue. About 12 cu.ft. of gas constituted a sample, and the dust from it weighed from 0.1 to about 4.0 grams.

The width of the flue was divided into 10 equal sections and readings taken at the centers of each section. One section and the check readings at the suction intake were determined per day, and the average dust content of the gases per section referred to the suction intake. The average of the 10 ratios so obtained was used to correct the dust loss computed from the large-scale determinations at the fixed suction intake. This correction was applied only in the case of the roaster flue, other cases showing only minor variations.

[3] "Journ. A. S. M. E.," VIII, Vol. XXX, p. 676 (December, 1915).

United States Smelting Report

The United States Smelting, Refining and Mining Co. for the year 1915 shows operating earnings of all companies of $7,579,184, from which allowances for depreciation, improvement and reserve amounted to $986,860, leaving net profits for the year of $6,592,324. From this, additional reserves for depreciation of $888,900 were allotted, dividends paid on the preferred stock of $1,702,225 (7% per annum), on the common of $263,336 (1½%), and $3,737,863 added to the previous surplus of $4,515,592, leaving an undistributed surplus as of Dec. 31, 1915, of $8,253,455. The common stock has since been placed on an 8% basis.

The metals produced (including those from custom ores) were: Copper, 26,923,674 lb., sold at $0.18183 per lb.; zinc, 34,105,471 lb., sold at $0.14964 per lb.; silver, 12,071,863 oz., sold at $0.49965 per oz.; lead, 87,102,179 lb., sold at $0.04546 per lb.; and gold, 196,481 oz. The ore tonnage from Centennial Eureka, Mammoth, Gold Road, Tennessee and Bingham mines was 1,066,025 tons.

Capital expenditures were: Securities of coal companies in Utah, $50,006; other stocks, $515,366; additions to plant in the United States and Mexico, $413,024; mine properties and other charges to capital account, $80,930; zinc properties in Kansas and Missouri, $953,598 less $600,000 reserve for depreciation, $353,598; total capital expenditures, $1,412,924. Current assets, eliminating intercompany accounts, were $17,343,239, of which $2,482,831 was cash, $3,867,148 notes receivable (including $3,418,612 loaned to the Utah Coal properties), $6,172,836 in metals in transit, in process and in hand, $1,287,128 in ores, mattes and byproducts and $1,573,611 in supplies, fuel and timber. Accounts payable (including payrolls) were $935,727; drafts in transit, $712,304; reserves for freight, refining, selling commission, etc., were $1,283,225; and dividends payable on Jan. 15, $688,893; making current liabilities only $3,620,148.

Zinc Properties

Owing to the wide spread between zinc-ore and spelter prices, the company acquired the smelteries at Altoona, Iola and La Harpe, Kan., with an estimated capacity of 250 tons daily, leased the Ravenswood mine, near Reeds, Mo., and erected a mill of 750 tons' daily capacity thereon.

The total cost of the zinc-smelting properties was $953,598, of which $600,000 was written off in 1915. The remainder of their cost will be written off in the coming year.

Coal output was 707,559 tons in 1915, as against 703,936 tons in 1914. All the coal companies will be consolidated into the United States Fuel Co. The $10,000,000 of 6% collateral-trust guaranteed notes of the Utah Co. and the $4,000,000 notes of the Smelting Refining and Mining Co. were called early in 1916 and an issue of $12,000,000 of 6% notes placed. These are due Feb. 1, 1926, and are convertible at any time, holder's option, into common stock at $75 per share.

Improvement at the Metal Mines

At the Bingham mines, Utah, the Niagara tunnel was widened and straightened and the level will be used hereafter as the main haulage route. Pneumatic locomotives were installed to replace the electric locomotives and will be used to supplement hand tramming. Shipments from the Bingham mines amounted to 94,166 tons of lead ore and 34,313 tons of copper ore.

At Midvale, Utah, the mill capacity was increased from 350 tons per day to 600 and will be increased to 675 tons. A new baghouse was erected and additions made to the ore-roasting department. An electrolytic process was developed for the recovery of cadmium from the flue dust. The Centennial-Eureka mine shipped 49,530 tons of ore. Development was continued in the Bullion Beck & Champion and a small tonnage of zinc and lead ores extracted.

At the Mammoth plant, Kennett, Calif., 290,473 tons of ore was produced, 46,027 tons of which carried a large percentage of zinc. The ore was sorted, the copper ore going to the Mammoth smeltery, the zinc ore to Kansas. At Gold Road, Ariz., the mine produced 96,272 tons, which was cyanided. A 1,500-ft. shaft was commenced. At Needles, Calif., a flotation plant was added to recover zinc from the tailings. The Tennessee mine at Chloride contributed most of the 47,897 tons treated.

The railroad situation still ties up the Richmond Eureka mines, Nev. The lead refinery at Grasselli, Ind., increased its capacity by 25% and the copper refinery at Chrome, N. J., by 10%. The Real del Monte y Pachuca mines in Mexico operated at 50 to 80% capacity despite the political situation and an epidemic of typhus.

The exploration department, under Sidney J. Jennings, examined data pertaining to 786 mines and immediately turned down 655. A preliminary field examination of 118 was made and a complete examination of 13. Beside the Reeds zinc property, an interest was acquired in an alunite property and a lease taken on a large number of claims in Leadville, Colo., which are being unwatered and developed. Work and litigation are being carried on at the Alaska property, and work is also being continued on the California property.

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The Shui-ko-shan Lead and Zinc Mine in Hunan Province is one of the important producers of these metals in China. Prior to the war, its products were under contract to go to Carlowitz & Co., of Hankow, but as they have been unable to fulfill their engagements in this respect, the Hunan Mining Board has decided to erect a smelting plant at Sungpo capable of turning out 100 tons of lead and zinc per day. The mines have been worked for centuries, and lately at the rate of 50,000 to 60,000 tons per annum. The ores contain galena, blende, iron and copper pyrites and occur at or near the contact of syenite and limestone.

Federal Government to Build Nitrate Plant

The Army Reorganization Bill as finally enacted authorizes the President to make an investigation to determine the best process "for the production of nitrates and other products for munitions of war and useful in the manufacture of fertilizers and other useful products." He is further authorized to select a water-power site or other site and to construct a plant for the manufacture of such product. The products of the plant are to be used for military and naval purposes to such extent as the President may deem necessary, and any surplus may be sold under such regulations as he may prescribe. The bill does not specify the capacity of the plant, but $20,000,000 is appropriated for its construction and an issue of Panama Canal bonds to raise the money is authorized in case sufficient funds in the treasury are not available. A provision is inserted that the plant must be operated "solely by the Government and not in conjunction with any other industry or enterprise carried on by private capital."

In view of the widely published fact that one of the most needed measures for national defense is the provision of a supply of nitrates that will be available for use at any time the shipment of nitrates from Chile is interrupted, there is no doubt that the Government will proceed promptly with the construction of the plant and more especially since it will furnish so many luscious plums for the faithful.

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New Colombian Mining Regulations

Under a decree regulating the granting of concessions for the working of mineral deposits on public lands in Colombia, concessions restricted to an area of 3.86 sq.mi. will be granted by that government for 25-yr. periods, says a recent consular report. Within 18 months of the approval of the contract the concessionaire must file with the Ministry of Public Works the precise location of his mine, plans of the workings and samples of the mineral. A further period of six months is allowed in which to commence mining operations.

The government claims the right to 15% of the gross receipts of the working and authorizes the concessionaire to erect all necessary buildings and to establish roads, railways, cableways, telegraph and telephone lines, etc.

Concessions granted to citizens of the republic may be transferred to aliens upon permission of the Colombian government.

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Improved Traffic Conditions

The net surplus of idle freight cars on the railroads of the United States and Canada on June 1 was 55,244, as compared with 30,607 on May 1, an increase of 24,637. The figures indicate a decrease in the volume of traffic, but railroad men point out that current reports of railroad earnings show no considerable slackening of improvement and are of the opinion that the increase in idle cars was due principally to the relief from the freight congestion. The increase was almost entirely in box-cars, and more of these became idle on the Western than on the Eastern lines, representing largely cars held in the East at the time of the congestion.

Dust Allaying in Rand Mines

By A. Cooper Key*

SYNOPSIS—Scientific counting of injurious dust particles in measured volumes of air shows that after blasting, the dusty mine air breathed by a miner in a minute contains 2,450 million injurious particles. This number can be reduced by water spraying to 10 million per minute.

The Transvaal Miners' Phthisis Prevention Committee has recently issued a special report on the percentage of injurious particles in mine dust and on the results of counting the particles of dust in the air. Experiments show that the measures in use for diminishing the quantity of very fine injurious particles of dust inhaled by mine workers, when properly applied, are efficacious.

It was arranged that, as far as possible, the experiments should be comparable among themselves, and to that end most of them were carried out at the Village Deep mine and in the same working place, tests for the efficiency of water sprays being made consecutively in one development end. Doctor McCrae's researches had showed that the silica particles found in silicotic lungs did not exceed 12 microns in diameter. It was therefore concluded that particles between 12 and 50 microns in diameter were relatively unimportant in the causation of disease, and that only those of less than 12 microns, called the very fine or injurious dust, need be taken into account. Each sample of dust was divided by sedimentation into two portions, containing the fine and very fine particles, with the dividing line at 12 microns. In addition, the number of siliceous particles was directly counted under the microscope in a small portion of the original suspension fluid, and from this the number of particles originally in the air could be calculated.

To establish some standard of comparison, observations were made of street dust in the town of Johannesburg, with wind blowing at least 30 mi. an hour. One sample, collected near the dump of the Robinson mine, contained 100 million particles per cubic meter of air; the other sample, of town dust, 39 million. The sample taken from near the dump contained 4 mg. of injurious dust, the town sample 2.4 mg. The percentages of injurious particles were 87 and 91 respectively, whereas nearly all samples of mine dust contain 98% by number. These above-

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DRILLING WITH 2¾-IN. MACHINE AND KEEPING DOWN DUST WITH WATER SPRAY

ground conditions may certainly be classed as very dusty. It is calculated that a person walking 3 mi. an hour in such dusty air would inhale 1,750,000 injurious particles per min. Such days occur only occasionally, however, and samples taken on ordinary days with 10-mi. winds would certainly give much lower results. A sample of mine air taken at a dead end on Monday morning—blasting having taken place on the previous Friday and drilling on Saturday—contained 170 million particles, of which 60% by weight was injurious. This air, when breathed by a person walking, would give him about 5

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million injurious particles per min., and judging by comparative figures, the human lung can withstand this amount of attack.

We consider now the worst kind of atmospheres produced by mining operations in the absence of dust-laying devices. Air sampled near the face of a drive 3 min. after blasting a 3-hole cut contained 86,000 million silica particles, practically all injurious. The average diameter of 2 to 3 microns was exceptionally small, and their number 1,000 times what was found in the streets on exceptional days and at least 100 times what usually is produced during all other mining operations except during dry-drilling. A second sample, taken about 25 min. after blasting, in an airway carrying air from several stope faces, gave rather lower results—62,000 million particles per cubic meter, practically all injurious. Nowadays, no one breathes such deadly air except where a regulation[1] is contravened. In this work the sampler was protected by a smoke helmet. The samples show the enormous quantities of very fine dust produced by blasting and the imperative necessity of preventing its inhalation by any mine worker.

Immediately after the air sample had been taken, a large and efficient water spray, was turned on for 30 min., after which two air samples gave 440 and 390 million particles entirely injurious. Two samples taken on the following day in the same drive, with the water spray turned on for 30 min. after the cut had been blasted, gave almost identical results. The residual unlaid dust was very little coarser than the original blasting dust, although in all four samples taken 99.4% of the number of particles in the original blasting dust had been removed by the water spray. In the unsprayed air a miner would breathe 2,400 million injurious particles every minute, while after 30 min. use of the water spray the number left to be breathed was only from 10 to 20 millions. This is by no means so good as street air, but is not likely to be a serious menace if breathed for only a short time, as is usual.

Dry-drilling is now prohibited by law, because it produces enormous quantities of dust. Samples of air taken near piston-type drills gave from 6,500 to 20,000 millions of particles per cu.m. Hammer-type drills give better results. With piston drills the percentage of injurious dust by weight varied from 65 to 78; with hammer drills it was only 31%.

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DRILLING UPPER WITH 3¾-IN. MACHINE, WATER SUPPLIED BY TUBE AT THE HOLE

Wet-drilling under normal conditions was the subject of 14 experiments. Four air samples taken from near Ingersoll drills gave good results—1,000, 850, 450 and 270 millions of particles per cu.m. The number of injurious particles breathable per minute was found to be about 18 millions. The lowest result was 8 millions, which is very satisfactory, being of about the same magnitude as that of street dust. Such results, however, cannot be obtained unless water is so introduced that

[1]Regulation 106 (32) prohibits entrance to ends, raises, winzes or other close places within 30 min. of putting the water spray in action, and then only if the air is free from dust, smoke and fumes perceptible by sight, smell or other senses.

the working point of the drill is constantly wetted. Two other air samples from near Ingersoll drills gave 1,900 millions and 53 millions of injurious particles breathable per minute. This is not satisfactory, being seven times the amount obtained under the best wet-drilling conditions. Five air samplings near Waugh drills gave rather better results—750, 370 and 300 millions. For some unknown reason these figures are not concordant with those of Leyner drills (hollow, with axial jet of water), from which the results were good but variable, owing to leaks of compressed air which atomized the dirty water with which they were fed. Theoretically, these drills should produce no dust at all, but they are unfortunately not proof against wear or rough usage. When in order they are capable of reducing breathable injurious dust to 3 million particles, which is excellent for underground. When not in order they give several times as much. In considering Leyner drills it was found that care had to be taken that they do not become so leaky as to atomize the water used, unless such water is free from sediment. Sediment, consisting largely of very fine particles, may be transferred into the air and thus into the lungs. In one instance, the number of particles per cubic meter was thus increased from 29 millions to 239 millions. Similar contamination takes place when dirty mine water is being atomized at any point of the mine. It is probably as dangerous to breathe the foggy air caused thereby as the clear air left after the evaporation of the fog. For atomizing purposes, only water quite free from injurious sediment should be used.

Air samples from crusher houses under bad conditions gave from 380 to 1,100 millions of particles, but under good conditions only 55 millions.

Blasting Produces Enormous Quantity of Dust

As a measure of the injurious character of any air breathed, the number of particles is a better criterion than weight. A small number of comparatively innocuous large particles add greatly to the weight, but not to the count of particles, as shown by the fact that in the majority of instances the number of particles of very fine injurious dust exceeds 98% of the total. Summarizing the report, it may be said that blasting operations produce enormous quantities of dust, the great bulk of which is very fine and most injurious. Its inhalation should be avoided at any cost. Machine drilling without water produces a smaller quantity of dangerous dust than blasting, but the amount is still very large and it is liable to be inhaled over a much longer period than air contaminated by blasting. By the use of water applied in a proper manner with suitable devices, the dangerous dust can be diminshed to a small fraction of that produced when drilling dry—in fact, to less than 1% of the original quantity, when it is comparatively innocuous. The imperative necessity of using proper devices for laying dust and constant vigilance in their application is emphasized. Ordinary mine water should not be used for spraying by means of atomizers. Leyner drills should be discarded if the air leaks, atomizing the water and causing fog.

It may reasonably be hoped that dust-laying and precautions in avoiding inhalation of air charged with dust have led, and will continue to lead, to a marked decrease in the liability of miners' phthisis. Coöperation between operator and miner are necessary to accomplish these much to be desired results.

The committee has drawn up a diagram embodying some of the main results of its investigation. It does not lend itself to reproduction in this form, but the figures given are striking enough in themselves even without diagrammatic aid. This diagram is being posted at all the Rand mines by the Chamber of Mines:

DUST IS DEADLY

Effects of dust allaying on number of particles breathed per minute:

	Millions of Dust Particles
BLASTING	
*Five minutes after blasting cut, no water spray	2,450
After using water spray for 30 min in drive	10
DRILLING	
3¼-In. Piston Drills:	
*Collaring dry	125
Collaring wet	57
*Drilling dry	330
Drilling with wet jet in hole	12
Watering with cup	28
Hammer Drills Without Water Feed:	
*Collaring dry	64
Collaring wet	8
*Drilling dry	18
Drilling with wet jet in hole	9
Hammer Drills With Efficient Water Feed:	
Collaring	3
Drilling	6
CRUSHER HOUSES	
Dusty conditions	31
Dust well laid	2
GENERAL	
Dust-laden air entering drive after blasting	1,770
Mine air after standing over Sunday	4
Street dust (excluding visible) on a dusty day	2

*Work under these conditions is prohibited by law.

USE WATER.

The figures given are the number of millions of particles of dust of $^1/_{2000}$ of an inch and less in diameter breathed per minute.

Mine-Law Violation as Negligence

By Arthur L. H. Street*

The principle that an employer is liable for injury to an employee directly resulting from the former's failure to comply with a statutory safety requirement, without regard to any question of carelessness in any other respect, was applied by the Tennessee Supreme Court recently in a suit brought against a zinc-mining company to recover for injury to a miner while being drawn up a shaft in a bucket. (Graham vs. American Zinc Co., 179 Southwestern Reporter, 138.)

The Tennessee mining statutes require that buckets used for hoisting purposes be covered and make provisions for certain structures inside shafts to make safe the ascent and descent of employees, and the court finds that these requirements were not complied with. It was objected by defendant that the laws did not apply because the mine in question had not been completed, but the court decided that it was sufficient that the shaft had been sunk and the construction of cross-entries had been begun.

Again it was asserted that plaintiff assumed the risk of being injured by remaining at work with knowledge that the safety laws had not been complied with, but the court overruled the contention, saying: "Such a conclusion would place the employer in the position of power which only the legislature should occupy, since it would enable him to either destroy or maintain the policies of the state according to his own will and purpose."

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Properties of Slime Cakes--I*

By E. E. Free†

SYNOPSIS—Theories of plasticity are discussed, and it is concluded that high plasticity in natural clays is probably due to films of gelatinous colloids about the particles. There is no evidence that these ever occur in slimes. The factors tending to increase or reduce colloidality of slimes are summarized.

By no means the whole of the difficulty in handling colloidal slime is due to slowness of settling and the other disturbances of sedimentation that have been discussed in previous articles of this series. As much or more trouble is caused by the imperviousness of a layer of such slime when settled or accumulated on a filter. From the practical viewpoint two properties are of outstanding importance—the retention of water in the slime cake and the resistance offered by the mass of slime to percolating liquids. Both are concerned with the size and number of the pore spaces between the slime particles, but the discussion of the factors controlling these pore spaces will be clearer if we preface it with some outline of another property of slime-like bodies—plasticity. As will be apparent presently, this is not really a property of normal metallurgical slimes. However, the clays and other typical plastics are not in themselves without interest to the metallurgist, and their study has shed important light on some of the more obscure phases of the subjects that concern us more specifically in these articles.

Classification of Theories of Plasticity

The definition of plasticity involves considerable difficulties; into which we shall not enter. In general three more or less distinct properties seem to be involved in the varying conceptions for which the term is employed. These are (1) the degree to which the mass can be kneaded or worked when wet, as putty is worked; (2) the tensile strength of the mass when dry; (3) the degree to which the mass will retain or increase its tensile strength on burning. The third of these depends upon many factors, such as the presence and binding power of fluxes, which are of no interest in the present connection, and this element of the conception of plasticity we shall ignore altogether. Of the two others, many authors insist that only the first should be called plasticity, the other being called by some other name. This difference of terminology seems unimportant, but it is important to remember that these two properties of workableness when wet and of strength when dry are not the same nor necessarily related. It is quite possible for a substance to possess either without possessing the other. In the literature the two concepts are hopelessly confused, and the attempt to relate both properties to the same set of causes is in large part responsible for the multitude of theories of plasticity that have been proposed.

These theories it is not necessary to discuss in detail, since they have already been reviewed very completely by Ashley in the papers frequently cited in the previous articles[1] and in the recent paper of Davis cited in the appended bibliography. It will suffice to say that the theories fall into four classes, which regard plasticity (and tensile strength) as due to:

1. Simple fineness of grain in connection with adhesive and other quasi molecular attractions between the particles.[2]

2. Some peculiar shape of the particles, permitting interlocking, unusual adhesion and the like.[3]

3. Capillarity and water-film actions between the particles, complicated by increased viscosity in these water films due to the presence of adsorbed salts, colloids or the like.[4]

4. The presence of enveloping films of gelatinous colloidal materials about the particles.[5]

It is manifest that some of these theories have prominently in view the matter of tensile strength, while others are concerned mainly with explaining the ease with which the plastic may be worked. It is just as manifest that none of these classes of explanation is entirely without importance. For instance, a certain fineness of grain is obviously requisite. One cannot imagine a plastic gravel. Practically, the interest focuses on differences in plasticity. Just as one slime is excessively colloidal and another not so, without apparent reason, so one clay is plastic and another useless without any visible relation to mineral composition, fineness of grain, shape of particle or other obvious property. It is these enigmatic differences which the theories of plasticity set out to explain.

Davis, in the paper mentioned, reviews all of these theories and concludes in favor of the fourth, regarding the presence of gelatinous coatings about the grains as the necessary and sufficient conditions for high plasticity. It must be understood, of course, that a material, to be plastic, must be of fine enough grain and otherwise suitable and that a certain small degree of plasticity will exist in all finely divided wet powders regardless of the presence of gelatinous coatings. The presence or absence of such coatings explains only the marked differences in plasticity between clays apparently similar otherwise. In this conclusion the writer concurs, but it should be noted that the conclusion applies only to natural clays and other normal plastics. Nothing is implied as to freshly ground rock powders such as slimes.

It will be useless to review the details of the evidence favoring the presence and efficacy of these gelatinous

*This is the eighth of a series of articles dealing with the subject of "Colloids in Ore Dressing." Former papers appeared in the issues of Feb. 5, Mar. 4, Mar. 18, Apr. 15 and 29, May 20 and June 3, 1916. The next article will be a continuation of the discussion of the "Properties of Slime Cakes," and will appear in an early issue.

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[1]Especially, U. S. Geological Survey, Bulletin 388 (1909); Bureau of Standards, Tech. Pap. 23 (1913).

[2]Haworth and Wheeler, "Missouri Geol. Survey," Vol. XI (1896); Grout, "Journ. Am. Chem. Soc.," Vol. XXVII, p. 1037 (1903); Atterberg, "Zeit. f. angew. Chemie," Vol. XXIV, pp. 928-9 (1911). For further literature see the papers of Davis and Ashley.

[3]Termier, "Comptes Rendus," Vol. CVIII, p. 1071 (1889); Linder, "Tonind.-Zeitung," Vol. XXXVI, p. 382 (1912).

[4]Purdy and Moore, "Trans. Am. Ceramic Soc.," Vol. XI, p. 582 (1909); Grout and Poppe, Ibid., Vol. XIV, p. 80 (1912).

[5]Schlösing, "Comptes Rendus," Vol. LXXIX, pp. 376, 473 (1874); Rohland, "Zeits. Anorg. Chem.," Vol. XXXI, p. 158 (1902), and many subsequent papers. See also the papers of Cushman and Davis cited in the bibliography.

coatings. Taking for granted the failure of plasticity (however defined) to correspond to mineral composition, shape or size of particle, or other tangible property of the clays, the other evidence may be summarized under four heads.

1. There are many parallels in behavior between very plastic clays and the gelatinous colloids such as albumin, gelatin and the like. Instances are the adsorptive power for dyes,[6] shrinkage and cracking on drying,[7] the rate of water loss to a dry atmosphere,[8] etc.

2. Plasticity is increased by the addition of vegetable extracts and other gelatinous substances, this having been a common ceramic procedure for centuries.[9] In at least a few cases organic gelatinous substances have been extracted from clays found to be very plastic.[10]

3. Plasticity is greatest in those clays that have been longest and most thoroughly exposed to the weathering agencies, which agencies are known to favor the production and supply of gelatinous colloidal materials.[11]

4. There are microscopically visible evidences of alteration at the surface of the particles of plastic clays, these evidences being mainly a more than ordinary roundness and unsharpness of contour[12] and a tendency for the surface layer to adsorb dyes in larger concentration (greater density of color) than is the case with fresh rock particles.[13]

It is easy to criticize this evidence and to point out, for instance, that the surface alterations visible under the microscope may well be illusions due to diffraction effects; that parallels with colloids in absorption, etc., may be due simply to extreme fineness of particle; that gelatinous organic materials are commonly present in natural soils and clays, plastic or nonplastic; and so on indefinitely. Space is lacking for detailed consideration of these criticisms and the writer can but record his opinion—by no means final—that the balance of evidence favors the real existence and importance of colloidal gelatinous coatings about the particles of the more plastic clays. For those especially interested the references given will provide introduction to the original literature.

Classification of Gelatinous Colloids

The gelatinous colloids which we suppose to be concerned in the production of high plasticity may be of two kinds; (1) the organic colloids like gelatin, tannin and some of the so-called humus substances of soil; and (2) the inorganic gelatinous colloids like colloidal silica, ferric hydroxide or alumina. Organic colloids of the type mentioned may result from the decay of vegetable matter and are present in many normal soils.[14] Many clays are formed or deposited under conditions permitting, if not requiring, the presence of such organic substances. Similarly the inorganic gelatinous substances mentioned may result from the weathering of feldspars, micas and other minerals from which clays may be formed.[15] Presumably colloids of either class may cause plasticity, but it seems probable that the organic materials are the more efficacious and that most, if not all, cases of unusually high plasticity are due to them rather than to their inorganic analogues. This seems especially probable with that part of plasticity which is indicated by ease of working. With the properties leading to high tensile strength on drying it is possible that the inorganic materials may be equally or more active since these inorganic colloids would seem more fitted to form coherent cementing films between the mineral grains than are the organic materials.

Turning from natural clays to artificial slimes, we are now in position to understand why it is improbable that the latter will contain the gelatinous substances believed to be important in the former. Gelatinous organic materials could scarcely be present in ordinary ores or enter accidentally during the process of milling. Inorganic colloids are more possible, but bodies of this kind are not known to exist ready formed in any ore, and the silica, alumina and iron present, even if cryptocrystalline or apparently amorphous, are not in condition to become gelatinous any more readily than the crystalline forms of the same minerals.[16] It is noteworthy, also, that slimes seldom if ever show plasticities comparable in degree with those of the more plastic natural clays. While it must be admitted that the evidence is entirely negative and amounts to no more than that gelatinous colloids have not been found in ores or in slimes, it seems nevertheless reasonably conclusive. In the previous articles I have attempted to show that the properties of slimes, colloidal and otherwise, can be explained without recourse to the hypothesis of gelatinous coatings. The fact, now admitted, that such coatings are present and probably important in clays and similar products of natural weathering is no reason for an assumption of their presence in slimes, since these latter are the product of entirely different processes very differently applied.

Application of Principles to Slime Particles

It will not qualify this conclusion essentially if we admit, as of course we must, that a certain degree of surface alteration will result from the action of water on slime particles and that a certain approach to a coating of, for instance, colloidal silica may be produced in this way. Such alteration is but one case of the interaction of particle and medium that occurs in nearly all suspensions and which has been discussed already. It undoubtedly has importance in flocculation and sedimentation phenomena, and it will appear below that there are probably noteworthy influences on the porosity and permeability of slime cakes. It is, however, a very different thing from the alien coatings of the plastic clays, and it does not seem ever to go far enough for the creation of an important true plasticity except, perhaps, with those unusual slimes that have been long exposed to the weather. In such cases, or where there has been artificial admixture of decaying vegetation or other organic matter, phenomena similar to those of plastic clays may be expected and all

[6] Ashley, loc. cit.

[7] Rohland, loc. cit. and his "Die Tone" (1909).

[8] Ashley, "Journ. Ind. and Eng. Chem.," Vol. III, pp. 91-5 (1910); Brown and Montgomery, U. S. Bur. Standards, Tech. Pap. 21, 23 pp. (1913).

[9] Acheson, "Trans. Amer. Cer. Soc.," Vol. VI, p. 31 (1904), and discussion; Ashley, "Tech. Pap. 23," pp. 82-4 (1913).

[10] Schlösing, loc. cit.; Davis, loc. cit.; Böttcher, "Sprechsaal," Vol. XIII, pp. 233, 252 (1908).

[11] Davis (loc. cit.) gives many instances.

[12] Cushman, U. S. Dept. of Agriculture, Bureau of Chemistry, Bulletin 92, 24 pp. (1905); "Trans. Amer. Cer. Soc.," Vol. VIII, p. 180 (1906); also papers cited in bibliography.

[13] Mellor, "Trans. English Ceramic Soc.," Vol. V, p. 72 (1907).

[14] Schreiner and Shorey, U. S. Dept. of Agriculture, Bureau of Soils, Bulletin 74, 48 pp. (1910); Cameron, "The Soil Solution," Chapter XI (1911).

[15] Cushman, loc. cit.; Sullivan, U. S. Geological Survey, Bulletin 312, 69 pp. (1907); Clarke, Ib. Bull. 491, "The Data of Geochemistry," pp. 454-78 (1911).

[16] The so-called "colloidal silica" of ores is really only cryptocrystalline silica. Though perhaps rightly called colloidal, it certainly is not an emulsoid (liquid-particle) colloid of the type of liquid colloidal silica, which type alone is believed to be efficacious in increasing plasticity.

colloidal slime troubles will be greatly aggravated in consequence.

A few practical deductions may be in order. The requisite conditions for plasticity (assuming an aqueous medium and bodies of the general nature of slim or clay) seem to be (1) a sufficient fineness of particle and (2) the presence of colloidal gelatinous coatings. Plasticity will be increased by fine grinding, but much more largely by the addition of a proper gelatinous substance. The organic colloids are most useful and are frequently so employed. Most substances insoluble in water can be made more or less plastic in this way, but this does not necessarily guarantee tensile strength when dry since the added gelatinous colloid may then lose its binding power. The surface alteration which automatically furnishes gelatinous films will be favored by fine division (since this increases surface), by long exposure to water or to weathering and by high temperature; this last acting by increasing the velocity of the weathering process. In slimes plasticity (and colloidality) will be increased somewhat by fine grinding, more largely by long grinding or by exposure to the elements or by grinding or exposure at high temperatures, and most largely by the addition of organic colloids. It must be emphasized, however, that with the exception of slimes long stored in the open or exposed to contamination with organic matter, the apparent degree of colloidality will be very much more largely controlled by the degree of flocculation as discussed in an article of this series than by surface alteration of the particles.

Military Engineers' Use of Pontons

"Military engineering," said Major P. S. Bond, Corps of Engineer, U. S. Army, in his talk before the Joint Committee on Military Engineering at Chicago, May 18, "is an adaptation of engineering, taken in its broadest sense, to military needs. Military engineering in contrast to civil practice consists of makeshifts and temporary expedients. The commanding general does not ask, 'How much will it cost?' but, 'How soon will it be ready?' Rough and ready makeshifts are the triumph of the military engineer."

Major Bond was with General Funston and Colonel Dodd in their Phillipine campaigns. Upon their arrival in the Phillipines, Colonel Dodd ordered a bridge to cross a certain stream. The engineer company was still on board its boat and all its equipage was unavailable, as it was still packed in the hold of the vessel. The call came at 11:30 p.m. The engineer troops disembarked, were on the scene of work at midnight, had the bridge well under way by 1 a.m. and by 3 a.m. had it completed. Before 7 o'clock in the morning Colonel Dodd's detachment had crossed the bridge in entire safety. This notwithstanding the fact that practically no tools and no plant whatever were available and the material for constructing the bridge was very scarce.

On Jan. 26, 1814, Napoleon wrote: "If I had had 10 pontons, I should have captured 10,000 wagons, beaten Prince Schartsenburg in detail, annihilated his army and closed the war; but for want of proper means I could not cross the Seine."

Writing to the Adjutant General under date of May 18, 1846, Gen. Zachary Taylor said: "My very limited means for crossing rivers prevented a complete prosecution of the victory of the 9th (Palo Alto). A ponton train, the necessity of which I exhibited to the department last year, would have enabled the army to cross on the evening of the battle, taken this city with all the artillery and stores of the enemy and a great number of prisoners—in short, to destroy entirely the Mexican army."

"Without proper equipment," said Major Bond, "improvised bridges would often take weeks to construct. What is known as ponton equipage is needed, and to operate this successfully requires experienced engineers. There is a regular routine for ponton construction, and so wonderfully simple is the equipage that unskilled men can be taught to use it in a very short time; but it takes an experienced officer to direct the work."

Galvanizing Processes

In Germany since the outbreak of war copper has been replaced by galvanized iron for many purposes. The *Journal of the Society of Chemical Industry,* Mar. 31, 1916, points out that galvanizing may be effected by the hot process, the electrolytic process, Schoop's metal-spraying process, or by sherardizing.

In the hot process, if the bath of molten zinc is allowed to solidify, it must be heated from above for remelting, otherwise the tank may be damaged owing to expansion of the zinc. The temperature of the bath must not be allowed to rise too high. Sheet iron galvanized by the hot process has about 400 gm. of zinc per sq.m. instead of about 1 kg. of zinc as formerly.

Cables for use in mines are now largely made from wire galvanized by the electrolytic process, because in wire galvanized by the hot process, unless the conditions are very carefully controlled, the strength may be materially reduced owing to the formation of a relatively brittle zinc-iron alloy. An advantage of electrolytic galvanizing is that it reveals defects, such as fine cracks or the like, in the iron, which would be concealed by hot galvanizing. It is also specially suitable for articles such as springs, which must not be heated to a high temperature. In the case of electrolytically galvanized sheet iron, a coating of 200 gm. of zinc per sq.m. is sufficient to prevent rusting.

Schoop's metal-spraying process is specially suitable for galvanizing large objects.

Sherardizing is particularly suitable when it is desired to preserve the finest details of the article to be galvanized; iron screws which have been galvanized by this process are ready for use without further treatment. Narrow tubes can be galvanized inside by sherardizing, and this process is used in making the 5 pf. galvanized-iron coins recently introduced in Germany.

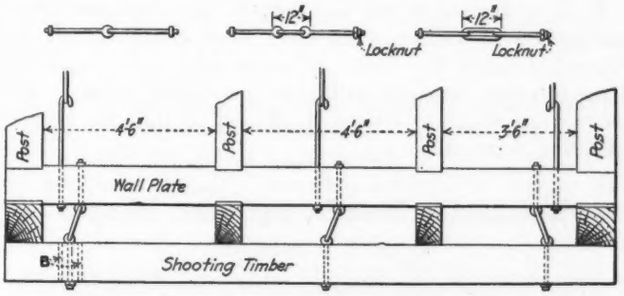
The Charcoal Iron Co. of America, Marquette, Mich., reports that profits from operation for the first quarter of 1916 totaled $220,739. From this sum was deducted $41,724 interest on borrowed money and special disbursement on plant account. This left a net balance of $179,015. Current indebtedness was reduced $147,000 during the three months, and $96,000 was expended upon capital account. The company purchased a steamship for $90,000. The company had orders for the first six months of the year for 60,177 tons of charcoal pig iron, while contracts are now being booked for the last half of this year and for delivery early in 1917.

Details of Practical Mining

Hanging Shooting Timbers in Shafts

By Atha A. Richie*

In most cases shooting timbers are hung on two straight rods. The objection to this system is that when the timbers are dropped before starting to put in a new set, one end usually falls ahead of the other and the straight rod is bent. As the rod has to be taken out and put in the other hole every time a set is put in, it is necessary to straighten it while still in the timber. Every shaftman knows about the difficulties encountered in doing this. Usually the miner takes a hammer and pounds on the end of the bolt until he finally gets it out. As a result the threads are so badly injured that the bolt must be sent to the surface to be rethreaded. In some places the shooting timbers are hung on chains, but as they are hard to keep hooked, the method is not a popular one. Rods made with a joint in the center are occasionally used also. These are all good methods, but it is the



DETAIL OF HANGING TIMBERS FOR SHOOTING

writer's opinion that the following is an improvement on them all.

The jointed rod already mentioned can at least be worked through the hole in the wall plate even though it may not be in exact line with the hole in the shooting timber. The jointed rod has to be changed from hole to hole every time a new set is put in. To overcome this feature I devised the link method, in which the rod is never taken from the shooting timber until continuous blasting has torn the timber away. If but one hole is bored in the shooting timber midway between the points where the holes *BB* are usually bored for all other methods and the link used, the upper end of the bolt can be swung so as to go into either of the holes of the wall plate. The lower nut should not leave the end of the bolt exposed to flying rocks from the shots as the threads would thus be left open to injury. The link and eyes in the bolt should not be more than 12 in. in length or they cannot be screwed up tight enough to hold the end and middle shooting timbers. If 10x10-in. timbers are used, the link and eyes together should not exceed 10 in. Shooting timbers 12x12 in. could be used in the center instead of 8x12 in., and they would give more protection to the dividers than the 8x8-in. piece would afford.

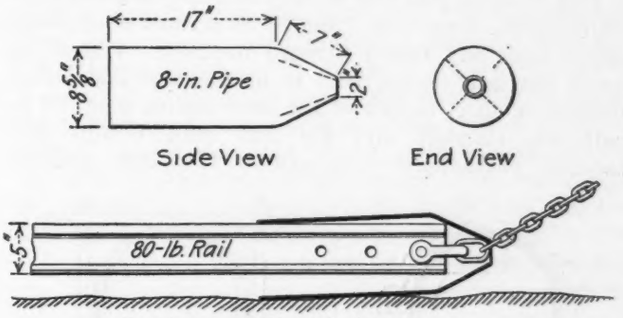
In the illustration *C* shows the two eye-bolts previously mentioned. These must be changed each time a new set is hung.

*Box 931, Tonopah, Nev.

Shoe for Hauling Rails in Openpit

By L. D. Davenport*

The accompanying sketch shows the details of a shoe used in the openpit mines in the Hibbing district, for hauling rails. This device prevents the end of the rail from burying itself in the uneven ground. It is often



SHOE FOR HAULING RAILS

quicker and cheaper to haul rails a short distance with a team than to load them on a push car and tram several hundred feet. Occasionally a pile of rails is left when a track is thrown a considerable distance, in which case hauling by team is the cheapest method of handling. In use the chain is threaded through the toe of the shoe and fastened to the rail with an ordinary clevis.

Shooting Soot from Stacks

When power-plant stacks accumulate enough soot to hinder the draft, they should be cleaned, but this is a disagreeable and unhandy job. A method of "shooting the stack" with powder is described in the *Du Pont Magazine,* by using a stack gun made as follows:

Bore a hole 1¾-in. diameter and 10 in. long in the center of a piece of 4-in. shafting 14 in. long. Then bore a horizontal hole ¼ in. diameter through the piece to the bottom of the center bore. The whole thing can be mounted on a pedestal about 6 in. in diameter so that it will stand in an upright position.

The method of operation is as follows: Pour some FFF blasting powder into the mouth of the cannon to about 2 in. from the top. Tamp to the collar with dry clay. A short piece of fuse is inserted in the touch-hole and in contact with the main powder charge. Open the flue

*Oliver Iron Mining Co., Hibbing, Minn.

door at the bottom of the stack, set the cannon on the bottom and in the center of the stack, light the fuse and close the flue door.

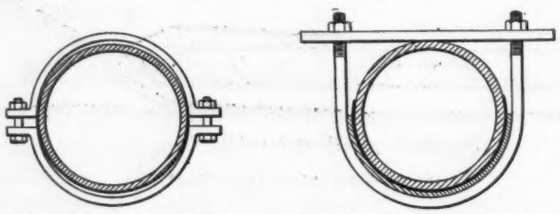
The explosion shakes and loosens the soot adhering to the sides, causing it to fall to the bottom. It can then be removed through the flue opening.

A charge of 8 in. of FFF powder, 1¾-in. diameter, is sufficient for a stack up to 100 ft. high and 4 ft. diameter or over. The number of shots necessary to thoroughly clean a stack depends upon its condition. Ordinarily three or four shots will clean a stack, but if very dirty it may require more. The size of the charge and length of the cannon can be regulated to suit the height and diameter of the stack.

There is no doubt about the efficiency of this "gun" for cleaning smoke-stacks. One of the largest manufacturing concerns in the country has used this method for several years, without an accident or injury to the stacks.

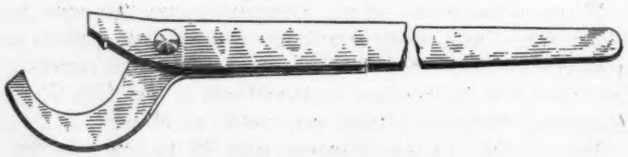
Pipe Repairing Kinks

In a 3½-mile pipe line recently laid for compressed-air transmission, there were found to be a number of places where holes had rusted through the pipe. Instead of using flat iron clamps bent to fit the pipe and bolted together, a short section of the same size of pipe slit in half was clamped over the leak with U-bolts and bar-iron yokes, says *Coal Age*. The first type of


Tightening bolts tend to spring clamp away from pipe as shown exaggerated
Short length of pipe of same size as line is used placing greatest pressure over leak

TWO METHODS OF PATCHING SPLIT PIPE

patch, which is commonly used, tends to spring away from the leak when its bolts are tightened, while the latter puts the pressure right on the leak and makes a better and cheaper patch. Of course, with either style of clamp, gaskets are required. Tar paper or pasteboard



A PAIR OF LAY TONGS

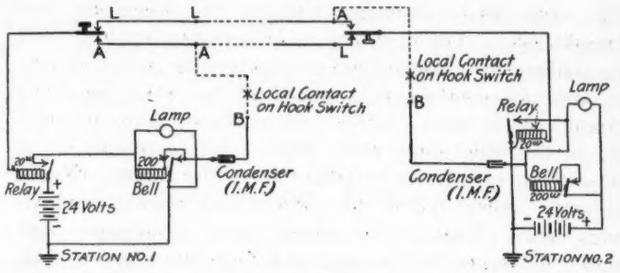
from ordinary boxes gives just as good results, at least for several months, as the highest-priced gasket material.

In laying a line of this length it is an advantage to use the regular "lay tongs" used in pipe-line construction in place of stillson wrenches or chain tongs. One size of tongs for each size of sleeve and at least two pairs for each size of pipe are required, and more would be better. For this line satisfactory progress was made with this number, in addition to chain tongs for holding the pipe section immediately adjacent to that being laid.

A Visible and Audible Signal

The following diagram for the simple and positive wiring of a signal system is given in the *Electrical Review and Western Electrician*. It will indicate at the sending and receiving points simultaneously, both by means of lights and gongs.

The self-restoring, three-point keys are simply assembled, or may be procured from any supply house. The relays should be of approximately 20 ohms resistance, and preferably of the knife-edge armature type. A relay of this type operating on a circuit of from 21 to 24 volts is



WIRING DIAGRAM FOR A VISIBLE AND AUDIBLE SIGNAL

very positive in operation, with a current consumption of only from 0.015 to 0.020 amp. This allows of its use on a circuit up to 1,000 ohms resistance one way. The bells should be wound for 24-volt operation and the lamps designed for the same voltage.

If it is desired to use the circuit for telephone communication as well, any standard local-battery telephone connected across the circuit in series with a condenser of 2 microfarads capacity will give the desired result. In the wiring diagram letters *A*, *B* and *L* indicate corresponding terminals.

A Cloth Backing for Maps

By A. I. Levorsen*

After considerable experimenting, the following was found to be a satisfactory and easy method of putting cloth on the backs of paper maps, drawings, etc., in order to strengthen them for field or office use.

The cloth is soaked in water and stretched as tightly as possible over a smooth board or table top, using thumbtacks or carpet tacks to hold it in position. The map or drawing to be mounted is also soaked, and a coat of paste is applied to the back of it as well as to the stretched cloth, rubbing the paste well into the meshes of the cloth. Pressure is then applied by means of a roller, to obtain a close contact between the cloth and the paper and to get rid of any excess paste. It is allowed to stand thus until dry. The paste used was the common wall-paper sort, which, if it should happen to get on the surface of the map, can be easily rubbed off without any harm being done. Care must be taken in soaking the print that the ink used does not run or smear, and also in applying the pressure, that the surface does not rub off. Unbleached muslin makes a strong backing cloth, and since it is of close weave, it will support the map if further work is to be done on it. With a little care the result is a joint that is stronger than the paper, leaving a neat and serviceable print that will stand much hard usage.

*Fergus Falls, Minn.

Mine Plant Water System

The question of water supply at a mine plant is an important one. Water is essential for operation and fire service. In large cities where the fire risk is frequent and great and the service demands are high, it is usually the practice to have two independent water systems—one of high pressure connected to the fire hydrants and the other of lower pressure connected to the house mains.

In deciding on the water system for a town site or mine plant, it is well to keep in mind the following factors: (1) Source and amount of water available; (2) fire risk—concentration and character of buildings, danger from outside sources of fire, brush fires, etc., danger from inside sources of fire, friction, storage of combustibles, etc., character of inhabitants; (3) needs of the project as a whole.

As a general rule it is considered safe to have the fire protection and service system combined into one system if the following points are observed:

(1) System laid out in a gridiron formation with a large circuit bordering the extreme area and smaller laterals within the area.

2. The presence of no dead ends in the system.

3. Distance between no two hydrants to be over 200 ft.

4. The presence of additional hydrants in the proximity to buildings, but not within 40 ft. of them.

5. In no case more than one hydrant on a 4-in. line or more than two on a 6-in. line between headers.

6. The location of sufficient gate valves to shut off as much as possible of the the area not affected in the case of fire in any region.

7. The location of a storage reservoir taking its suction from a sufficient source and having sufficient capacity for at least two hours' requirements under fire conditions.

8. The location of a pump taking its suction from the reservoir and having its discharge connected to the main header. This pump should be capable of maintaining the pressure at 80 lb. or more throughout the system.

A system of this character was laid out, in a specific instance, with these main points in view and, after a few minor changes, was pronounced acceptable to the insurance inspector. The source of supply consisted of three 8-in. supply lines—two of cast iron and one of wood—which were connected to the main header. Each line was provided with a post indicator valve, the key of which was in the posession of the fire chief. These at all times indicated which of the intakes were closed and which open. In addition to these valves, check valves were provided set against the return of water to the river from which it was drawn. The object of these valves was to prevent plant water under high pressure from returning to the river pumping station in time of fire and at the same time permit low-pressure water (20 lb.) from the pumping plant to enter another part of the header and flow into the reservoir. The main header connecting these three intakes was one end of the gridiron circuit and consisted of 8-in. cast iron. From this header a branch of 8-in. cast-iron pipe fed the reservoir. An electrically driven pump fed the water into the mains at 80 lb. pressure. Gate valves were placed at all intersections so that the high pressure could be directed into any section. The positions of all gate valves were indicated by white signposts set in the ground pointing toward the valve and showing the distance to the valve from the head of the post. Where the water lines run down the center of passageways, these valve heads were capped with a section of 4-in. cast-iron pipe with the bell upward and a wooden block in the top.

The water system was laid out on a blueprint of the plant in colored pencil, and the size of pipe and type of connections, location of valves, etc., were indicated. This was given to the field engineer, who usually located the center line of the pipe by stakes every 50 ft. marked "6-in. water line." A good deal of trouble was experienced in getting the hydrants in their proper position so that they would line up properly at constant distances from foundations. As the hydrants were 16 ft. from the mains, this distance was laid off at right angles to the main and three stakes put in. The first gave the center line for the excavation, and the hydrant was placed in line with two others set 16 ft. from the center line of the main and on each side of the hydrant location. After a few hydrants were reset, the rest were usually lined up correctly the first time. The excavation was uniformly 3 ft. below the ground level, so that it was unnecessary to give grades on the center-line stakes. However, the foreman and engineer went over the ground together and in places where cuts and fills were expected later, the excavation was deepened or shallowed to give an ultimate final depth of 3 ft. As soon as the excavation of a main and hydrant-line trench was completed, the pipefitter foreman, having previously been given a blueprint marked similarly to that of the engineer, laid out the bell holes in the bottom of the trench. These were spaced to accommodate the necessary bells on the pipe and also fittings, valves, etc. It might be mentioned here that the engineer had to keep a weather eye out and see that the pipefitter foreman was notified immediately upon the completion of a section and that he immediately laid out the holes, or else a delay was very likely at this point. As soon as they were laid out, the laborers excavated them 6 in. deep. During or before the excavation the necessary pipe fittings and pig lead were delivered to the ditch. The pipefitters then packed the joints with oakum and leaded them. After a line had been laid backfilling was dumped over the middle of the pipes for anchoring.

The ditches for the local connections were meanwhile laid out and dug. Taps were made in the top of the main by a hand tap, the water having been turned off after the test. The mains were cast iron and the local connections galvanized. In making these taps, care should be taken to see that expansion in the local connection is allowed for. This was done conveniently by using two 90° bends at right angles, giving a flexible joint.

The line was then tested out with gradually increased pressure until the final fire pressure was reached. If no leaks were developed, the installation was accepted by the engineers and the excavations were backfilled, care being taken to tamp well during the filling. The hydrants were "backed" with a wagonload of coarse gravel or slag to give them a firm setting and also give drainage for any small leaks or drips encountered.

Small Jackhamers are used successfully in loosening up glacial drift when blasting is impractical. In the New York subway construction, drift is loosened by this method and sluiced to waste similarly to hydraulic methods of mining. Large boulders can be undermined with the jackhamer until the point of safety is almost reached and the final dislodgement accomplished by a well directed stream of water.

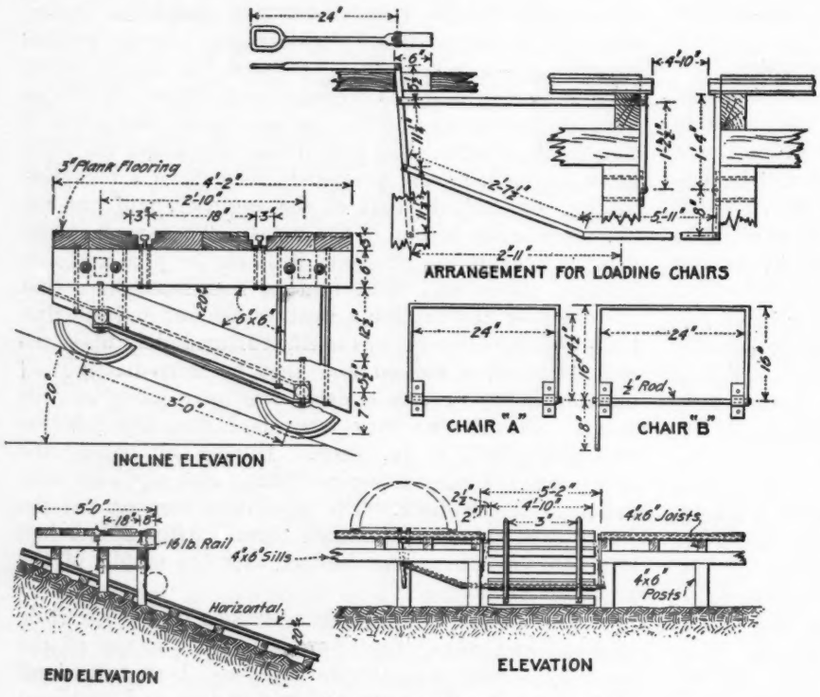
Details of Milling and Smelting

Transfer Truck and Chairs

By Roy F. Smith*

The accompanying sketches show a transfer truck and landing chairs recently designed for an inclined cable tramway, operation on a 20° slope at the side of a mill. Platforms are to be placed at the top and bottom of the incline and at three intermediate points on the levels of the main floors of the mill.

This truck has a 30-in. gage and a 36-in. wheelbase. It is built to accomodate either mine cars or trucks having 18-in. gage and either 18- or 24-in. wheelbases. It will also be used to hoist machinery and structural



THE TRANSFER TRUCK AND CHAIRS

material during the period of mill construction. The frame of the truck is constructed of 4x6-in. and 6x6-in. timbers on which is laid 3-in. plank flooring and the mine-car rails. In order to sprag the mine cars on the transfer truck, ¾x¾x20-in. long slots are cut in the flooring in which to lay two pieces of bar iron. The weight of the truck is 800 lb.

Landing chairs of the type shown can be easily made from ordinary stock by the mine blacksmith. The link connecting the chairs on opposite sides of the incline passes beneath the track.

While this was designed for this particular mill job it can be used in underground work and permits hoisting in an incline without transferring loads to skips besides saving the price of the skips and the cost of an elaborate skip-dumping device at the collar of the shaft.

*Mining engineer, 1845 Grant Ave., Denver, Colo.

Smelting Operations at Greenwood in 1915

The annual report of the Canada Copper Corporation, Ltd., the holding company for the British Columbia Copper Co., which operates a smeltery at Greenwood, B. C., gives the following data relative to its smelting operations, which were resumed by the blowing in of one furnace July 26 after a protracted period of idleness.

Average metallurgical conditions were fair during the period of operation. A slightly reduced tonnage per furnace over former operations was obtained, due to running a more refractory charge than formerly. The supply of ore available permitted the operation of only one furnace.

The total amount of ore smelted during the period was 122,514 tons dry weight, which consisted of 115,140 tons of company ores and 7,374 tons of custom ores. The coke used represented 14.44% of the total charge and contained 22% ash. The time of actual operation was 158 furnace days, and the actual amount of ore smelted per day per furnace was 775.4 tons. The work was performed by an average of 49.2 men per day, with an average wage of $3.48 per day.

Ore shipments from the Mother Lode mine were 105,085 tons dry weight, the average analysis of which was, gold, 0.037 oz.; silver, 0.21 oz.; copper, 0.8746%; silica, 28.5%; iron, 21.2%; lime, 17.7%; sulphur, 3.15% per ton. The Lone Star mine shipped 6,510 tons dry weight which assayed gold, 0.032 oz. per ton; silver, 0.193 oz. per ton; copper, 2.60%. The Queen Victoria mine shipped 754 tons dry weight, which averaged 0.0037 oz. gold, 0.77 oz. silver and 2.28% copper. There was produced 1,850 tons of matte, averaging 48% copper per ton. The amount of slag made was 105,280 tons, containing 0.0043 oz. gold per ton, 0.072 oz. silver per ton, and 0.286% copper. The rest of the analysis was, silica, 3.85%; iron, 23.5%; lime, 20.5%. The production of metals amounted to 1,734,385 lb. of copper, 23,003 oz. of silver and 5,417 oz. of gold.

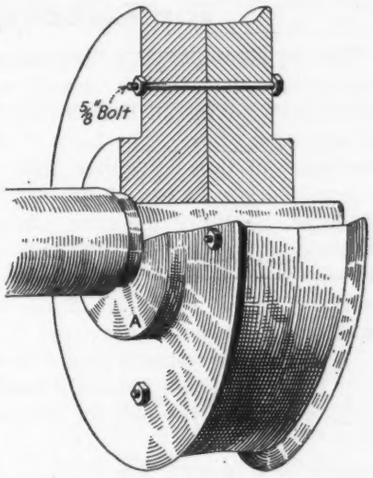
Reduction of Oxides by Hydrogen at High Temperatures

Experiments have recently been made by E. Newbery and J. N. Pring (*Proc.* Royal Soc., Vol. 92, p. 276) on the reduction of metallic oxides by hydrogen at about 2,500° C. and pressures up to 150 atmospheres, the resulting water being partly decomposed with sodium. Cr_2O_3 and MnO_2 were reduced to metals whose melting points

were 1,615° ± 15° C. and 1,230° ± 5° C. respectively. From the sharpness of the melting points it was inferred that these specimens were purer than those hitherto produced. V_2O_5 was reduced to VO, Nb_2O_5 to NbO, U_3O_8 to UO_2, TiO_2 to TiO, CeO_2 to Ce_2O_3, while Al_2O_3, MgO, ZrO_2, Y_2O_3 and ThO_2 were unchanged.

Old Mine-Car Wheels

Two discarded mine-car wheels placed face to face on a shaft make a good roller for carrying the cable of an inclined hoist. At any mine there are usually several old car wheels on the scrap heap. To take these and make a cable roller is a simple task that any mine blacksmith can accomplish in two hours. The job is a particularly easy one, provided the wheels were loose on the car axle. With most car wheels the hub protrudes beyond the outer rim. Knock this hub off with a sledge and chisel and then place the wheel flat under a drill press and drill four $\frac{11}{16}$-in. holes as illustrated. Two wheels having been prepared in this manner, they are placed face to face and bolted together with $\frac{5}{8}$-in. bolts and driven on the shaft. Any shaft with a diameter smaller than that of the bearing hole in the wheels will do, as the wheels can be shimmed to fit. This is also true if the bearing within the wheels has been badly worn. The flanges prevent the cable from slipping off, and the chilled bearing surface of the wheels wear well under the cable. Rejected car axles can be used as shafts for the rollers, provided the ends are not so badly worn that they will not give a good bearing in the boxes.



CAR WHEELS BOLTED TOGETHER

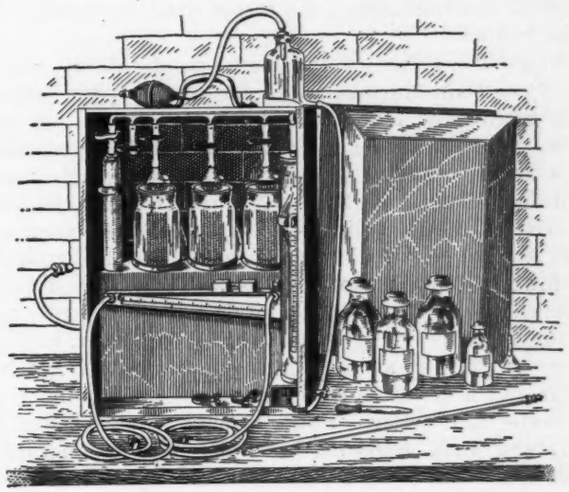
Volumetric Determination of Cadmium and Zinc

Tests have been made by H. Enell to determine whether the reaction $CdS + I_2 = CdI_2 + S$ can be used for the determination of cadmium (*Zeit. Anal. Chem.*, Vol. 54, 1915, p. 537; abstr. *Journ. Soc. Chem. Ind.*, Feb. 29, 1915). The precipitated cadmium sulphide was washed free from hydrogen sulphide and the filter and precipitate vigorously shaken with 50 c.c. of water and a measured volume of standard iodine solution. Finally the excess of iodine was titrated with standard thiosulphate solution. It was found that the reaction between the cadmium sulphide and the iodine took from 14 to 24 hr. for completion. Good results can be obtained, but the method cannot be regarded as entirely satisfactory.

Accurate results can be obtained by a method based on the reaction, $CdS + 2\,AgNO_3 = Ag_2S + Cd(NO_3)_2$, which takes place quickly and quantitatively. The precipitated cadmium sulphide is washed with warm 2% ammonium-sulphate solution till free from hydrogen sulphide, and paper and precipitate are then vigorously shaken with 50 c.c. of water. An excess of N/10 silver-nitrate solution is added, the mixture well shaken, 5 c.c. of 25% nitric acid added, the mixture again well shaken and, after standing for a few minutes, filtered through pulp. Iron alum is added to the filtrate, which measures about 250-300 c.c., and the excess of silver nitrate is determined by titration with N/10 ammonium-thiocyanate solution. The same method is applicable to the estimation of zinc, which is precipitated as sulphide in acetic-acid solution, the chief difficulty being to avoid contamination of the zinc by iron.

Dwight Furnace-Efficiency Case

The three symptoms which indicate good or bad furnace conditions and combustion efficiency are flue-gas analysis, flue-gas temperature and draft. The first two factors show the degree of efficiency, and the draft helps to locate trouble when present. The Dwight furnace-efficiency case contains instruments for measuring all of these three factors, comprising a flue-gas apparatus, a draft gage, a draft thermometer with the necessary tubing, chemicals, funnel, filler, extra parts and a book of instructions for using the outfit.


DWIGHT FURNACE-EFFICIENCY CASE

This apparatus, which has just been adopted by the Carnegie Steel Co. after investigation, is being put on the market by the Dwight Manufacturing Co., 12-14 South Jefferson St., Chicago, Ill.

The Effects of Addition Agents in electrolytic silver-refining baths were reported on by F. C. Mathers and J. R. Kuebler at the Washington, D. C., meeting of the American Electrochemical Society, Apr. 27-29. Tartaric acid is said to be the most effective agent in producing solid, adherent deposits from silver-nitrate baths. A good composition is 3% each of silver as silver nitrate, nitric acid and tartaric acid. The further addition of 0.01% of glue twice daily makes the deposit much smoother, darker and more shiny. This same effect is produced by 2% of ferric nitrate (the cathodes then showed 0.086% of iron). If economy is desired at the expense of smoothness, 0.5% of tartaric acid and 0.01% of glue may be used twice daily. More tartaric acid must be added after about 1 gram of silver has been deposited per cubic centimeter of solution. The deposit is brittle and hence is of no value for plating.

The Assayer and Chemist

Determination of Tungsten

By Edward J. Sheda*

The usual methods for the quantitative determination of tungsten, such as decomposition by *aqua regia,* fusion or leaching with caustic soda, afterward precipitating by mercurous nitrate, or decomposition by hydrochloric and hydrofluoric acids, while giving good results are not entirely free from criticism. The mercurous-nitrate method gives good results under proper conditions, but requires special skill in manipulating. The hydrofluoric method entails the use of considerable expensive platinum ware, and the *aqua regia* method is tedious and it is very difficult to get perfect decomposition with it.

The method I have worked out is a modification of the *aqua regia* method and has been used in several hundred determinations, the result checking closely. It is as follows:

Weigh 0.5 grams of the finely powdered ore into a small porcelain crucible, add 2 grams of sulphur flowers. Mix thoroughly, cover with 4 grams more of the sulphur, place the lid on the porcelain crucible, preferably in a muffle, heat hot enough to ignite the sulphur and continue to heat for 20 min. Now increase the heat to drive off the remaining sulphur, take off the cover and heat to a red heat for 5 min. Allow to cool and transfer by brushing into a No. 1 beaker. Treat with 4 parts hydrochloric acid and 1 part nitric acid; boil gently until decomposed—it may take from ½ to 1½ hr. boiling. Now evaporate to about 3 cc., dilute with 30 cc. of hot water and 5 cc. of hydrochloric acid, boil 5 min., then let settle until clear. Filter through double paper (9 cm.) and wash well with hot water slightly acidulated with hydrochloric acid. Dissolve the tungstic acid on the filter with a hot solution containing 30 cc. of ammonia, 7 grams of ammonium carbonate and 250 cc. of water. Make about seven washings using as little as possible. Receive the filtrate in a tared 50-cc. porcelain dish. Evaporate the solution on water bath to dryness, and then ignite the residue at a red heat, cool and weigh as WO_3.

Determination of Alumina in Silicates

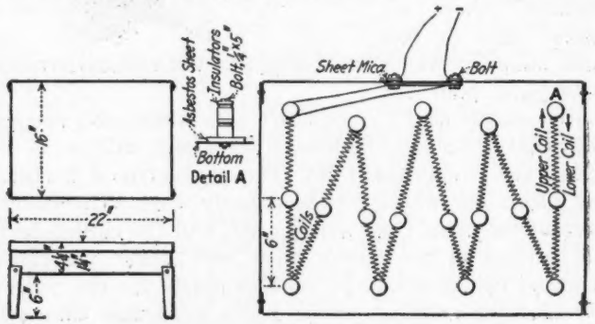
The proper method of determining alumina in silicates has recently been investigated by E. Selch (*Zeit. Anal. Chem.,* Vol. 54, 1915, p. 395; abstr. *Journ.* Soc. Chem. Ind., Feb. 29, 1916). Decomposition of silicates with hydrofluoric acid and sulphuric acid yields satisfactory results if the last traces of fluorine are removed by treating the residue with dilute sulphuric acid, evaporating the mixture and expelling the sulphuric acid by heat. The residue is then dissolved in hydrochloric acid and the alumina precipitated in the usual way. If the silicate is decomposed by fusion with alkali carbonates, the alumina should be treated with hydrofluoric acid and sulphuric acid, evaporated, and ignited until again constant in weight; any loss that takes place is due to silica, and a corresponding weight is added to that of the main quantity of silica. The latter should also be treated with hydrofluoric acid and sulphuric acid, and any residue remaining after ignition should be counted as alumina.

*Chemist, Henry E. Wood Ore Testing Co., Denver, Colo.

Home-Made Electric Hot Plate for Laboratory

In the accompanying illustration is shown an electric laboratory plate that is cheaply and easily made, gives sufficient heat for all that is required of a hot plate and is safe to operate. The body of the plate is made from one piece of thin galvanized iron, the edges bent up and riveted, forming a box 22 in. long by 14 in. wide and 4½ in. high. A lid of the same material, forming the plate surface, with edges 1¼ in. high and just large enough to slip over the body of the plate, is made in the same manner. Four legs, also of the same material, are cut and riveted to the body, raising it 6 in. from the surface.

A sheet of asbestos is placed in the bottom of the box, and 17 sets of small porcelain insulators in superimposed pairs are bolted through the bottom of the box by means



CONVENIENT ELECTRIC HOT PLATE

of ¼x5-in. bolts. The lead wires from the hot plate are connected over one phase of a 440-volt alternating-current three-phase circuit and are brought in through the side of the plate body by means of short bolts insulated from the plate body by sheet mica. The lead wires are brought to the upper and lower insulators of the first set, as shown in the illustration, and there connected to the series of resistance coils. These coils, of No. 16 Climax resistance wire, made by winding about a round stick, are strung in a series from one upper insulator to the next and from one lower insulator to the next, until the point *A* is reached, where the connection is made.

A small rheostat and a knife switch at a convenient place on the wall complete the equipment. If one heat will suffice, the rheostat is not necessary.

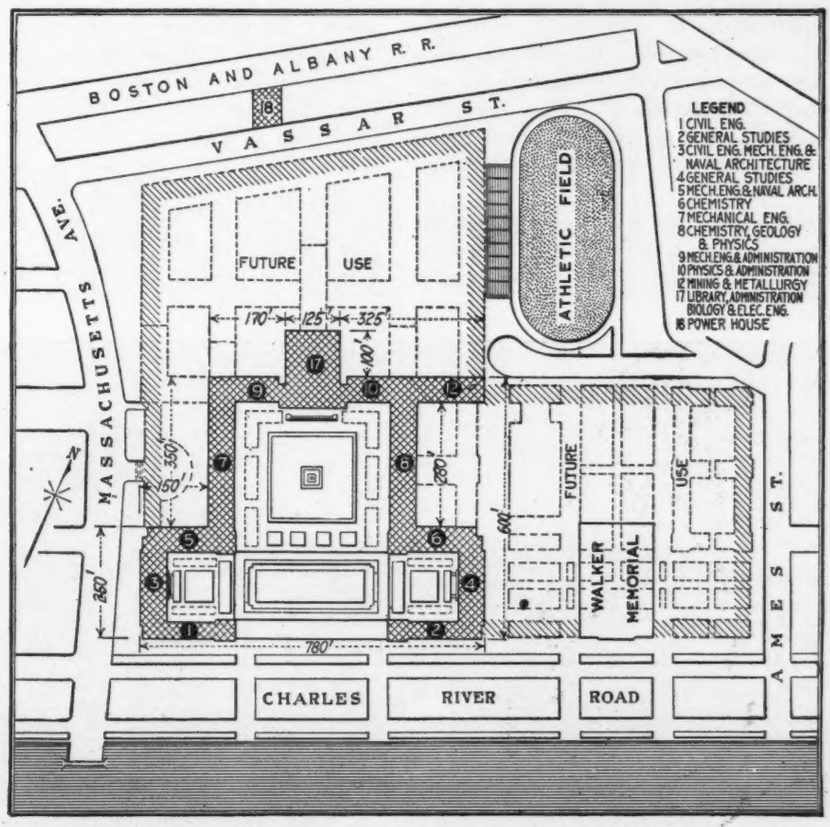
The wires are all completely insulated from the body of the plate, even should one of the coils burn through and both ends fall to the bottom of the box. In case of a broken coil it is an easy matter to remove the plate lid and make the necessary repairs.

The New Technology

EDITORIAL CORRESPONDENCE

SYNOPSIS—The Massachusetts Institute of Technology celebrated its Golden Jubilee this week. Very fittingly this was also the occasion of the dedication of its magnificent new buildings, where the Institute and Harvard University will hereafter coöperate in the education of engineers. This article gives a general description of the grounds and buildings and of the ceremonies accompanying their occupation.

It is quite unlikely that there is devoted to educational purposes any other group of buildings that combines greater advantages of situation and construction than are found in the new grounds and buildings of the Massachusetts Institute of Technology. In the midst of Greater Boston at an imposing place on the Charles River Esplanade the Institute has secured the land and has erected the structure shown on the following page. Incidentally it is of interest to mention that the design, engineering and construction of these buildings have been in the hands of Technology graduates. The method of planning for the new buildings followed an unusual course. Customarily when one wishes to construct a building the architect is called in and all matters are put into his control. Here the beginning was at the other end, and plans already fairly well outlined were put into the architect's hands to be developed in final detail.



PLAN OF THE NEW MASSACHUSETTS INSTITUTE OF TECHNOLOGY

When the plot in Cambridge was purchased, President MacLaurin sent first to the heads of all the departments of Technology, asking each one to make plans for his department as if there were no other department in the Institute. The same procedure was requested of the Walker Memorial and Athletic Council, so that well-developed outlines were furnished by men who were themselves experts in planning, being the heads of civil and other engineering departments. When the ideas of these principal men were developed to a degree, Mr. MacLaurin called them together; then followed a coördination of the different plannings. The result is now manifest in substantial form, and the Massachusetts Institute of Technology is moving into a new home that from subfoundation to roof is especially suitable for the purpose for which it is intended.

One of the items that was not overlooked was the question of distance to travel. This has impressed itself upon the minds of the students of the former Institute, where, with the several buildings on different streets and quite widely separated, the five-minute interval between lectures proved to be scant time in which to get from one detached laboratory to an equally detached drafting room. The consideration of allied courses was therefore made by the registrar, and those courses which were likely to be taken by the same student in his standard work, or the most popular of the options, were placed in departments close together. In a group of buildings of which the axis is nearly one-half a mile in length, the importance of this arrangement will be appreciated. The educational portion of the new Technology buildings may be described as a connected group of buildings three and four stories in height, attached to, and on each side of, the library. The library is the hub and predominating feature of the construction, and its great dome looks down on the court from a height of nearly 200 ft. This central court, which is open to the river front, expands when near the Esplanade into two large minor courts. These and other courts interior to the buildings insure the necessary lighting of the rooms. These courts are flanked by the department buildings, and the latter are linked together so as to afford circulation under one roof throughout all portions of the structure. It will be unnecessary for the student to don a raincoat and go out of doors in passing from one exercise to another. The comparatively narrow buildings receive light from both sides, and in addition all of the drafting rooms are on the top floor, where there are skylights hidden by the parapets.

The fundamental principle of interior construction comprises a system of bays of uniform size, which may be compared to the sectional bookcase in the home library. The floors are hung on the walls entirely free of the partitions. Rooms can be made in any multiple of the unit by merely removing partitions; and since these do not support floors, the desired changes will be easy and inexpensive. Each department may thus have its rooms suited to its future needs instead of modifying its future needs to suit the limitations of its rooms.

In addition to providing for this expansion of room space the plans also permit growth of the various building sections or wings. There is a chance of enlarging the departments in future buildings, and the present construction affords the opportunity of erecting extensions or wings so that any department may expand into a building suited to its needs. These will be added usually either in one or two directions, but with some departments three directions are possible.

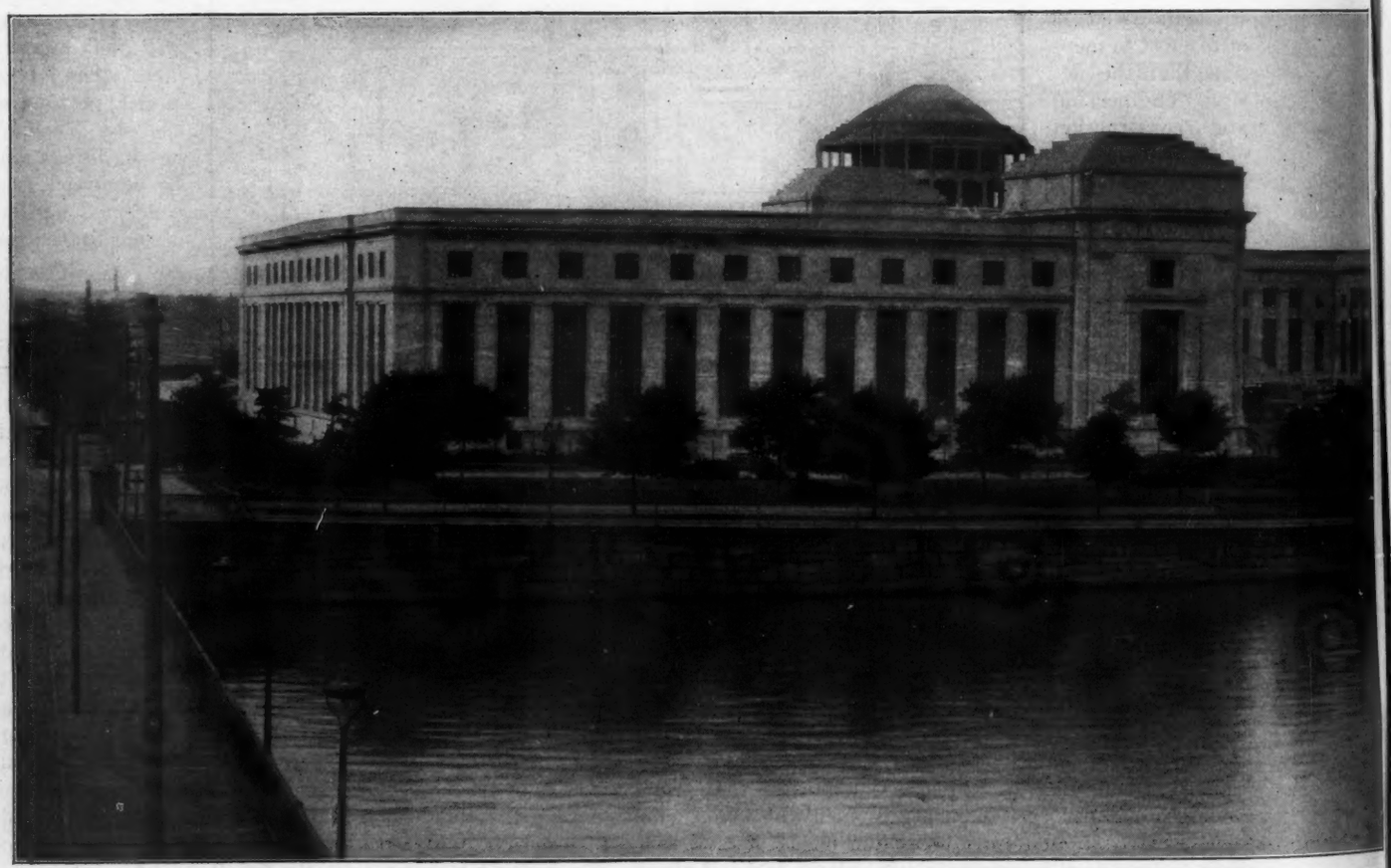
This planning is the result of careful consideration of the needs of the Institute by the various technical men at the head of the departments, in consultation with the architect. Unknown as they are today, the common needs of any department can be met without disarranging any of the other established departments. This provision for the future will assure to the departments about twice as much space as they receive now, when Technology has taken possession.

The great court embraced by the wings opens upon the Charles River Esplanade, the boulevard established by the Metropolitan Park Commission. The frontage of the Technology lot is 1,500 ft. along this, while the length along Massachusetts Ave. is nearly the same. Half of the property is to be devoted to the educational purposes, and the other half will be for social facilities, which the Institute has heretofore lacked. It is the intention to develop the Walker Memorial, an undergraduate club house, gymnasium, commons, a dormitory system and other student features.

The view from the river shows strikingly the splendid proportions of the whole group. It is not possible to get the proper depth of the court from the illustration, but it must be remembered that the central dome of the library is about 600 ft. back from the Esplanade.

Educators from all parts of the world have been in Boston this week for the dedicatory exercises of the new buildings and the celebration of the fiftieth anniversary of the establishment of the Institute.

An interesting spectacular feature of the exercises was the water festival of Monday, held in the Charles River basin. The Institute has demonstrated to the citizens of Boston the adaptability of that body of water to aquatic sports. In addition to the masque and pageant held in the Court of Honor of the new buildings a spectacle of interest was the formal transfer of the archives of the Institute from the old buildings to the new site. A procession of the corporation and faculty of the Institute assembled at the Rogers Building and proceeded to the basin. Here, after the fashion established long ago in ancient Venice, the officials of Technology then made their first formal entry into Cambridge over the waters of the basin in a Boston-built barge.



THE NEW BUILDINGS OF THE MASSACHUSETTS

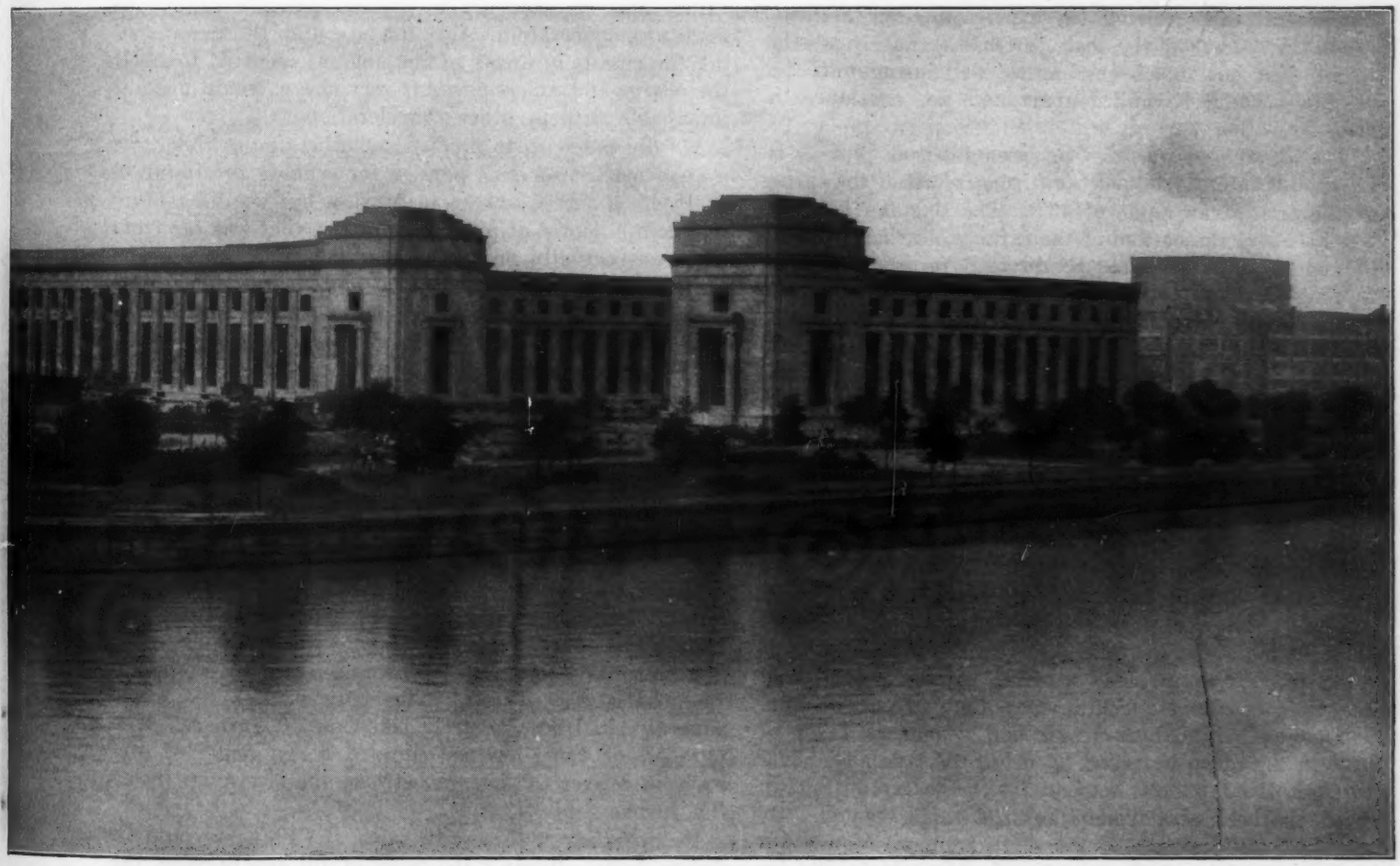
This vessel is something new in American naval architecture. The after-deck rises in tiers following the pattern of the ancient vessels, making an elevated quarter-deck for the highest officials. The rail is broken in places to form entrances to the vessel, and at these points are exquisite decorations. The hold above the lower deck is provided with openings through which the oarsmen propel the vessel on its way. Fifty Technology students have competed with their fellows for the honor of rowing this unique barge.

Boston has wonderful opportunities in the Charles River basin for the pleasure of its people, but these have thus far been practically neglected. This week, two torpedo boats and a submarine were in the basin, and a race in pulling crews in boats from the warships stationed in Boston helped furnish excitement. The Technology class crews had a race, and races of single shells and war canoes rounded out the exposition of speed coming from the application of muscle.

Following the exposition of muscle and what is sometimes called the "ash breeze," came examples of speed from the wind, as shown in races of yachts and sailing canoes. Yet another step forward, and speed from power—mechanical power—was shown by fast motor boats in action, not only by what we usually understand by "motor boats," but sea-sleds as well and a patrol squadron of five submarine chasers.

Overhead, aëroplanes performed various evolutions, and a most unusual and interesting demonstration of a man-carrying kite was made by Samuel F. Perkens, a Technology graduate, who volunteered to show the results of his studies and invention along these lines. The crowning attraction in the alumni proceedings was the pageant and masque. The court of the buildings furnishes a setting such as is seldom found within the limits of a great city. The buildings were illuminated with the same degree of skill that characterized the lighting of the San Francisco exposition, the electrical engineer who had charge of the latter being in charge of the illumination here. As the flotilla carrying the faculty and honored guests and bearing the archives of the Institute arrived at the embankment, the signal was given for the beginning of festivities. In the middle of the court was a space fitted with all the devices of a modern stage. Spotlights illuminated special features, while flood lighting and vertical rays gave rise to interesting color effects.

In this arena there was delineated step by step man's progress in conquering the forces of nature. The huge circle was filled with thousands of elements—students and other participants—in chaos and confusion, a magnificent spectacle of uncoördinated jostling forces. It was a world without rule. Primordial man sees this world and thinks to conquer it. He is represented by a group of the huskiest of Technology students, selected with care because of their physical prowess. Again and again savage man enters the circle and again and again is flung out by the forces that do not know his bidding. Growing more and more intelligent and calling to his aid great principles working with Reason and Will and Skill—symbolical characters that come to his aid—he subdues chaos, and order and civilization are established.



INSTITUTE OF TECHNOLOGY AS SEEN FROM HARVARD BRIDGE

Correspondence and Discussion

Electrothermic Zinc Smelting

In the *Journal* of June 3 appeared an editorial on electrothermic zinc smelting, in which it is remarked that in these times of great excitement in the zinc industry so little development should be made in this line. I can answer that by giving the result of some experimental work on the zinky copper ores of the Teziutlan Copper Co., at La Aurora, Estado Puebla, Mexico, in 1913.

The general average of these ores was 4% Cu and 10% Zn, but ore containing as much as 28% Zn could be selected from the mine, and it was on this selected ore that the experimental work was done. About three tons was crushed and roasted to 2% of sulphur, which was the lowest we could roast it with the means at hand. This consisted of a core-baking oven in the foundry.

The electric furnace was 2 ft. square in section and 2½ ft. to the spring of the arch, through which the charge was to be fed from a funnel which was kept full. The first trial was made with a carbon electrode buried in the bottom of the furnace and connected by copper supplied from the converters to wires and the transformers. The other electrode came down through the arch and was a carbon rod 4 in. diameter by 48 in. long.

The transformer was rated at 3,000 amp. at 110 volts, but several times during the experiments the ammeter needle ran clear off the scale, so that it was impossible to tell just how much current we were using until the electrodes could be pulled apart and the resistance increased.

The condenser was a 7-in. wrought-iron pipe 8 ft. long, built into the side of the furnace shaft at the spring of the arch at an angle of 45°. The slag tap hole was 2½ in. above the bottom of the furnace, so that a reserve of melted material would be retained for starting after tapping slag and matte. The walls of the furnace were 9 in. thick, of firebrick, and bound together with angle iron on corners and by tie-rods. The charge consisted of roasted ore mixed with 16% of powdered coke and charcoal.

The first start was made by carrying molten slag and later matte from the blast furnace in crucibles and pouring it into the electric furnace through the charge hole until there was a contact between the vertical electrode and the submerged electrode through the slag and matte. It developed that this was not a good method of starting, and later it was found that when we used two electrodes coming together at an angle through the arch, we could start easily by using a little scrap iron or copper held up by a wooden pole against the ends of the electrodes when the current was on.

This caused a short-circuit and developed a lot of heat in the scrap iron, and by using the pole as a poker through the tap hole, we could stir the scrap iron up when the heat development was not rapid enough. By adding a little charge to the scrap iron, we soon got a mass of fused material, and after that the chief difficulty was to avoid using too much current, thereby endangering the transformer.

The first trial resulted in a runaway around the submerged electrode, and then we put both electrodes through the arch so that they came together at an angle of 45°. In order to make a tight joint around the electrodes where they passed through the brickwork, asbestos packing and wet clay were used.

The first trial run was made with a cement bag tied over the end of the 8-ft. length of 7-in. wrought pipe that served as a condenser. After two hours the zinc vapor came through the condenser so rapidly that the bag was ignited, and thereafter the zinc flame burned at the mouth of the condenser. The condenser was partly filled with a powdery substance that by analysis showed up to 75% Zn. This powder burned spontaneously when exposed to the air.

There was no metallic zinc in the condenser in a liquid condition. Analysis showed that unreduced charge had been blown into the condenser by the zinc vapor acting like a blast from a tuyere. Here is the whole difficulty with electric smelting of zinc ores. When the furnace is in operation at full capacity, the evolution of zinc vapor is so rapid that it blows a part of the unreduced charge into the condenser along with the zinc vapor, and consequently a finished product cannot be made at one operation. Also, the heat absorbed in vaporizing the zinc is in excess of the amount required to smelt the charge and unless power is very cheap, would make it impossible without other considerations.

We did not wish to produce metallic zinc as there was a good market for zinc powder for cyanide precipitation at Pachuca and elsewhere in Mexico, but we did require to attain a degree of purity of product that was far from what was actually produced. Several trials were made, but always with the same result, and then a change was made in the furnace, but it never started again, for reasons that will appear later.

It occurred to me that if charge were blown into the condenser, it must be because the zinc vapor was obliged to pass through the charge in order to get into the condenser. Therefore, instead of putting the charge in at the top of the furnace and having the electrodes surrounded by it, why not force it in to the bottom of the furnace by a piston and smelt on top of the charge? This seemed a logical solution of the difficulty, and it seemed as good as done. Fortunately we had some old air cylinders that had been used to operate ore gates on bins, and one of these was fitted with a ram 2 in. in diameter, working in a pipe connected with a hopper. The charge was placed in the hopper after the whole apparatus had been securely bolted to the furnace. The plunger, or ram, inclined upward at an angle of 45° so as to deliver the charge between the electrodes inside the furnace.

By operating a three-way valve, the plunger could be drawn back, allowing the pipe to fill partly with the

powdered charge. Then, by a turn of the valve handle, the pressure on the air piston was to force the charge up into the furnace. That is as far as it ever went, for the plunger jammed in the pipe full of loose dry powder and would not or could not be moved by 3,000 lb. pressure on a 2-in. plunger. I then reduced the diameter of the plunger to 1½ in. and later to 1¼ in., without result. The charge could not be forced through a pipe 18 in. long with a free discharge, on account of the friction and packing. If this could not be done when there was no resistance, it was plainly out of the question when the charge was partly fused and pasty.

Philadelphia, June 3, 1916. HIRAM W. HIXON.

[This is an interesting record of experience. The entrainment of ore dust by the zinc vapor in tearing out of the charge is a difficulty, as Mr. Hixon suggests, but it ought to be controlled in another and less muscular way than he proposes, and can be. The introduction of the ore beneath the slag was the subject of a patent by Tharaldsen, which has previously been described in the *Journal*.—Editor.]

Age and Experience vs. Youth and Education

The question of age and experience vs. youth and education has come to my attention in one form or another a great many times. It is the inevitable attendant of progress. The younger generation of keen, educated men replacing older men having a wealth of experience is a common sight. This, however, is not the phase of the question I wish to discuss. In mining work and in construction in particular, it is the practice to have young engineers in charge of small areas, all being under the supervision of a resident engineer. They are responsible for the progress of the work in their area. Under their supervision are foremen of the different types of labor used. These men are older and more experienced, but for the most part not highly educated.

The engineers are on a salary basis and on the "staff," while the foremen are on an hourly basis, although their monthly average pay is the equal or superior of the engineers. In construction work there are many times when a few hours' overtime in concrete pouring or brickwork will mean the saving of a day or more later on. For this work the foreman and laborers receive overtime, while the engineer, who is bound to be on the job when any work is being done, receives nothing. The engineer is supposed to judge of the advisability of overtime work and apply it whenever it is of economic advantage.

An engineer is supposed to know how to lay out work so that it will be carried on in the most expeditious manner. He is supposed to see that the requisite quantities of all materials reach the proper place simultaneously with the arrival of properly supervised labor of the type to handle the material. He is supposed to see that the work is carried on according to best engineering practice at the least cost. It is evident that he is the goat upon whose frame any and all errors and delays are finally hung. The handling of several hundred men on winter construction is no sinecure for the labor foreman, and many are his trials. Being on an hourly basis, however, he always has the privilege of quitting and stands a good chance of being immediately rehired on some other portion of the work or on the same work later. The engineer, however, is bound by salary conditions to stay at least one more month and by the ethics of his profession until the job is finished. In one instance that I recall, seven labor foremen were successively in charge of the labor on some winter concrete work extending over a period of two months. On account of weather conditions and overtime, the work was very hard and called for a high degree of ability and endurance. Cement finishers worked under electric lights until midnight, and concrete mixing started at 6 a.m. It was no uncommon occurrence for the engineer to be routed out at 6:30 Sunday morning to check some grades or interpret a blueprint. He always had to make the round of the finishers before turning in at night. Th engineer on this job of course did not quit, but carried the work through, breaking in a new labor foreman every week. At its completion he made his detailed cost statement. This did not check very accurately the figures of the original estimate (which he did not make), so that he received nothing but a reprimand for his services. The job ran about $50,000, and the engineer's salary for the period was about $250, or ½%.

Another instance that I recall was a sewer system. This ran about $20,000, and the engineer's salary was $100 of it, while the item of superintendence ran $1,000, or 5%. As the customary allowance for engineering and superintendence is from 5 to 15% of the total value of the work, would it not be good economics to raise the engineer's "ante" a bit? He has the power to reduce costs more than any other one individual by his ability and knowledge. Can't his remuneration be commensurate with his ability and responsibility?

I recall with regret the case of a transitman, a college graduate, who resigned from the engineering force and obtained a carpenter's job, as the remuneration was about $45 more a month and the hours easier!

Of course the advocates of underpaid engineers will bring out the questions of "future," "experience," "promotion in a good company," etc., but working at the question from the purely utilitarian viewpoint of dollars and cents to the mine operator or construction company, wouldn't it be a good idea to raise the young engineer's salary enough to place him on a par with his labor foremen, at least? Is it a good idea for our young transitmen of today (who should be the engineers of tomorrow) to forsake the ranks of engineering, even temporarily, for the trades?

Just as I write this, I receive a letter from one of our leading mining schools, which says that muckers can get jobs from $125 to $150 per month, while recent graduates acting in the capacity of surveyors, assayers, samplers, etc., receive $90 to $100 per month. I should appreciate hearing the company viewpoint on this subject.

New York City, May 27, 1916 FRITZ WILLIAMS.

Horizontal Drill Holes

We notice with interest an item appearing in the *Journal* of May 27, 1916, p. 961, which suggests that a diamond-drill hole recently drilled 1,680-ft. deep is a world's record for horizontal holes. This company drilled one such horizontal hole at No. 6 Quincy shaft, Houghton County, Mich., 1,870 ft. with an E. J. Longyear Co. No. 2 hydraulic machine. E. J. LONGYEAR CO.

Minneapolis, Minn., June 2, 1916.

Editorials

Galvanizers as Zinc Smelters

One of the developments in the zinc industry that probably will be of great industrial importance is the extent to which galvanizers have been going into the production of spelter on their own account. The most noteworthy example is of course the United States Steel Corporation, which already has three large plants—Carondelet, Cherryvale and Donora—and probably will build another in course of time. The largest single consumer of spelter is therefore not only supplying a large part of its own requirements already, but may some day supply all of it. Other galvanizers have begun to do the same thing.

Although this development was started by the extravagances in the spelter market since the war began and the consequent paralyzing of the galvanizing business, it is by no means unnatural or likely to be merely ephemeral. Many of the steel makers who do galvanizing also perform processes in which large quantities of sulphuric acid are required for pickling purposes. It is therefore logical for them to look favorably upon a raw material—blende—which will furnish them with both zinc and sulphuric acid. In producing them directly at the point of consumption, there may be, moreover, some saving in freight.

It is manifest that when the brass makers cease to buy spelter for ammunition making and when the zinc industry reverts to its normal basis, the absence from the market of some of the large galvanizers is going to be keenly felt. Certainly the spelter market will be narrower than it was formerly. While many of the new smelteries that have lately been built will be abandoned when the boom departs, it looks as though the plants of the galvanizers would be permanent institutions. Donora presents such an appearance to everyone who visits it.

The Fixation of Nitrogen

Nitrogen, which is the largest component part of the air, consists of a molecule made up of two atoms bound together by the equivalent of three bonds of affinity, or as the chemist would say, it has a valence of three. When nitrogen exists alone, as it does in the mechanical mixture known as air, it is a perfectly inert, inactive gas and does not enter readily into chemical combination. If, however, these two atoms of nitrogen in the molecule are torn apart, each one of them is in an actively unsatisfied state and is prepared to fix itself into many combinations with other elements. In other words, the molecule of nitrogen is quiet and harmless, whereas the free atom of nitrogen is dynamically very, and sometimes terribly, reactive. If each one of the molecular bonds of nitrogen is satisfied with hydrogen, we have NH_3, or ammonia, with which we are all familiar and which is a much more important compound than is generally realized. In tearing apart this molecule of nitrogen, it is necessary to fix each atom of the nitrogen to three atoms of some other element, say hydrogen, in order to make a stable compound. This is what is meant by the fixation of nitrogen. The molecule of nitrogen is of little use to mankind, but the atom of nitrogen is of very great importance and is the most necessary element to plant and vegetable life and the most necessary element in the manufacture of explosives for the destruction of life. Nitrogen fertilizers are used throughout the world at the rate of about $200,000,000 worth a year. Either decrease in price of fertilizer or increase in education and betterment in farming methods will lead to an enormously increased consumption.

The manufacture of synthetic nitrates by the fixation of nitrogen is all-important at the present time, for reasons too well known to need repetition. There are three principal methods by which this fixation is accomplished at present. The original process was based on experiments made as far back as 1785, which showed that electric sparks passed through air would enable the oxygen thereof to burn some of the nitrogen, thereby oxidizing it to nitrous vapors. The Bradley & Lovejoy process which was worked out at Niagara Falls, the results of which were published in 1902, was the first successful industrial process for converting the nitrogen of the air into nitric acid by means of the electric arc. This same result, by means of differently constructed apparatus, has been achieved by various other investigators whose names attach to their particular method, of which perhaps more is heard of the Pauling process now than any other. In Norway the abundant water power prompted the greatest development in this line. So that at the present time more than 200,000 electrical horsepower is being used in the manufacture of artificial saltpeter with further additions in hand and contemplated which will bring the total power consummed to about 500,000 hp.

More largely used than this process is that for synthesis by treating calcium carbide in the electric arc, whereby nitrogen is converted into calcium cyanamide (C_2N_2), which is an excellent fertilizer by itself. By treating this cyanamide with steam, under certain conditions, ammonia is produced, or this may form the starting point of the manufacture of cyanide. For the utilization of this process Dr. Baekeland says there are to-day three factories in Germany, two in Norway, two in Sweden, one in France, one in Switzerland, two in Italy, one in Austria, one in Japan and one in Canada, but not one in the United States. A total of 200,000 hp. is used for this entire output of cyanamide with plans made for further plant extension, one English company contemplating the application of 600,000 hp. in Norway and 400,000 hp. in Iceland to cyanamide production.

Owing to the fact that certain metals and metalloids will combine with nitrogen to form nitrides, another type of process has been developed, of which the Serpek is perhaps most prominent. Nitrides can be used directly as fertilizers, or they can be made to produce ammonia under suitable treatment. A German process has succeeded in obtaining aluminum nitride with the use of

an amount of electrical energy claimed to be one-eighth that needed for the electric-arc process and one-half that for the cyanamide process—the result being calculated for equal weights of fixed nitrogen. Pure alumina for the manufacture of aluminum metal can be produced by this process.

A fourth method is the Haber process, which consists in the direct synthesis of ammonia by the union of hydrogen and nitrogen direct and has been developed in Germany to such a wonderful commercial success that all German capital has been withdrawn from the Norwegian fixation plants and concentrated in the commercial installations of the Haber process, the prime advantage of which is that it is not dependent upon cheap power.

Germany has a population nearly three-quarters that of the United States, although occupying an area less than 80% that of the State of Texas; nevertheless, she is said to produce under normal conditions 95% of the foodstuffs that she consumes. Germany accomplishes this because she uses seven times as much fertilizer as the United States per acre cultivated. It is estimated that her powder bill for one day alone during the present war averages about $1,000,000. There seems to be no denying, therefore, that her existence at the present time depends upon the high state of development to which she has brought the fixation of atmospheric nitrogen.

The Southern Electro-Chemical Co., at Great Falls, S. C., about 50 mi. south of Charlotte, N. C., has erected a small experimental plant to produce about four tons of nitric acid daily by the application of the arc method known as the Pauling process. The Southern Aluminium Co., at Whitney, N. C., which has for several years been building a large plant for the manufacture of aluminum at a site where the abundant water power of the Yadkin River can be utilized, plans to start the manufacture of alumina by a thoroughly tested commercial process and then to change over unit by unit to the Serpek process, which has not been tried out on a commercial scale. In this Serpek process aluminum nitride is formed from bauxite and then this nitride is decomposed to form ammonia and alumina, which is the nitride method of nitrogen fixation already mentioned.

There is therefore in this country at this time no synthetic nitrate production of any consequence. The proposition for the Government to father a nitrate plant, passed by Congress, touches a matter most vital to the welfare of the United States in both times of peace and times of war if such times should come. There are various processes which are commercial successes and are extensively used. Lack of cheap power, which costs one-third less in Norway than our cheapest at Niagara Falls, has heretofore been the bugaboo of attempts to start the industry in this country.

In 1898 Sir Williams Crookes, in his presidential address before the British Association for the Advancement of Science, called attention to the fact that, at the then increasing rate of consumption, the nitrate beds of Chile, the only important world's supply of natural nitrates, would be exhausted before the middle of this century. Nitrogen fixation, therefore, will have to be developed in this country unless we are to shift our dependence for nitrates and nitric acid from Chile to some European country which employes fixation processes.

Uninformed persons lay stress on the utilization of all byproduct coke-oven ammonia for the production of nitric acid in time of war. The production of coke-oven ammonia is an extremely variable quantity and, like the production of coke, depends upon the fluctuations of the iron industry. The production of ammonia from this source in any normal year is entirely inadequate for safe reliance in the event of war, but it is not readily available either for that use or for fertilizer purposes because it originates in more than 20 different places scattered between the Atlantic Coast and the Mississippi River and between the Gulf of Mexico and the Canadian border. The conserving and collecting of the ammoniacal liquors from these various plants and shipping to some central plant would be impractical in time of stress, to say the least.

There are steps which the Government could rightfully take to foster the starting in this country of nitrogen-fixation plants but the appropriation of $20,000,000 for the installation of a government plant for nitrogen fixation is as unjustifiable as is the appropriation of $11,000,000 for an armor-plate plant or a proportionately large sum for a copper smeltery or a zinc plant.

Chances in Mining Propositions

The fact that the Canadian Mining and Exploration Co., organized by powerful and prominent interests to acquire and develop mining properties, liquidated after having investigated 1,500 propositions without finding one sufficiently attractive to induce it to undertake its exploitation is still being used in various ways as a sad commentary on the chances which a nonexpert investor in mining stock has of picking a winner, and moreover to show that the mining industry is on the wane, that good mines are no longer to be found. This notion, however, fails to take into consideration fundamental differences in the policies of the several exploration and development companies.

One of our largest and most successful mining organizations maintains an exploration department, and according to its annual report for 1915, had presented to it for consideration 786 properties. Of these 655 were rejected after an office examination of the reports and data submitted. A preliminary field examination of 118 was made, and 13 properties were accorded a complete examination. For the year previous 639 properties were offered. Of these 538 were rejected after an office examination of the reports and data submitted. A preliminary field examination of 82 was made, and in the case of 19 properties a complete sampling and examination was undertaken. Now the policy of this company is to acquire only mines that have a sufficient tonnage of ore developed to show them a profit under their scheme of operation. Many mines today operating at a loss could be worked at a profit by an organization as large as the one we are considering, and it is on this margin of operating returns and on its capabilities of more extensive and more intensive operations that this company relies. So that prospects, no matter how promising, are not considered.

Another of our largest mining concerns operates on an entirely different basis, considering only prospects and declining to undertake the purchase or acquisition of a developed mine. We are not informed as to the number of propositions this company considers in the course of a year, but from its policy it might reject perfectly good, developed mines, which fact would be no reflection on

the propositions, because the very same mines might be most desirable from the standpoint of the other company just cited.

We have in mind another company, not incorporated, composed of very wealthy men experienced in the mining business, who are continually on the still hunt for good mining properties. They will not consider a prospect, but only a mine with a developed tonnage, and while unlike the other company we have just mentioned, they have no operating organization, they have the means for equipping a property that is suffering from lack of or poor equipment and inadequate working capital and making from a mediocre property a big success, as they have recently done in one instance in British Columbia. The men in this aggregation say: "Why should we go through the worry and mental anguish of developing a prospect when we do not have to?" So that by this aggregation also, prospects, no matter how alluring, will not be considered.

The Gold Road, a revamped old producer; the Miami, made from a prospect into a big mine; and the Hedley, a re-equipped and enlarged producing mine turned into a big dividend payer, are specific examples of the results of the respective policies enumerated.

More prominent than any of these three companies is the Jackling-Hayden-Stone group, which up to now has made a specialty of handling only propositions of enormous size that are of such low grade that only operations of great magnitude can be made to pay. The Utah Copper, Ray, Chino and Alaska Gold are too familiar to need further mention.

Of course, when a company lets it be known that it is in the market for mining propositions, it is sure to be deluged with all sorts and kinds, a comparatively large number of which will probably, in any event, not withstand a rigid office examination. However, owing to the different policies of the companies, the number of rejections that they make, of the propositions submitted, is not an index of the value of the propositions considered. It shows not that there are no good mining propositions to be had, but only that the particular kind of proposition to fit their specified requirements was in the minority.

New mines are being found continually and developed into big successes. The most shining examples recently have been the Interstate-Callahan, now the third largest zinc producer in the world; the United Eastern, the new banner property of the Oatman gold-mining district in Arizona; the Mascot zinc mine, in Tennessee; the White Pine copper, in Michigan; the Magma, the Commonwealth, and finally, the United Verde Extension, all in Arizona, the last, perhaps the least well-known of any, but one of the most striking copper discoveries of the period.

The Plymouth Consolidated, in California, an old mine for a long time dormant, has been made into a successful mine by Bewick, Moreing & Co., which company has now taken over the Eureka mine, also in California, and expects to bring it to the point of successful exploitation. The New Cornelia, at Ajo, Ariz., is a comparatively recent acquisition by another mine, which promises big success, as does also the Burro Mountain, being developed by Phelps-Dodge at Tyrone, N. M. The Matahambre copper mine in Cuba, the Yukon Gold's new operations in California and in Iditarod, Alaska, the Tonopah Mining Co.'s acquisition of placers in Colorado and many others come to mind, of new mines found and developed or old ones, failures, rejuvenated and made profitable. The number of exploration companies mentioned is not by any means a full list, but merely typical.

Not only is the field of opportunity not barren, but there is a marked need of an exploitation company for the handling of comparatively small properties. There is always a large number of such promising prospects held by men who need capital, but who cannot interest the larger companies that disdain small-scale operations. The propositions either need a moderate amount of capital to put them on a producing basis or a reasonable fund to develop them to a stage where they will be attractive to some of the larger exploration companies. Then to bring them before these larger companies would also be a proper function of this exploitation company of the new type suggested.

Metallography Applied to Ores

When the first papers by William Campbell and C. W. Knight, dealing with the examination of ores and other opaque minerals by reflected light on polished surfaces, were published in the *Engineering and Mining Journal* and in *Economic Geology* in 1906, few geologists realized the effectiveness and scope of this new application of metallography. Ten years have passed since then, and during this time the technique of the method has been slowly evolved. The proper ways of preparation and polishing have been ascertained, delicate microscopes with strong illumination have been perfected, and each investigator has painfully worked out ways of mineral diagnosis, not easy by any means to the beginner. Some of these methods, like that of Koenigsberger, based on the polarization of reflected light, or that by Leo, based on the colors produced by slight etching, have proved ineffective. At the present time etching by acids, potassium cyanide, ferric sulphate, etc., supplemented by other microchemical tests and by observations on color and hardness, have proved the most satisfactory means of diagnosis, but a comprehensive record of these reactions was still lacking.

For this reason geologists and mining engineers should welcome a little book just published by Joseph Murdoch, for several years an assistant and associate of Prof. L. C. Graton. With the greatest care Dr. Murdoch has ascertained the reactions for practically all opaque minerals, and they are so arranged that in skilled hands the identification of each mineral becomes comparatively easy. It is optimistically stated by the publishers that the method is so perfect that previous experience is unnecessary. This must be taken with a large grain of salt. While there is no such necessity of thorough knowledge of optics as in ordinary microscopic work with thin sections and transparent minerals, the novice will find all kinds of pitfalls, and his conclusions as to genetic relations of minerals may prove valueless. The literature of metallographic research applied to ore deposits already contains much evidence of dilettantism, and it is to be hoped that budding authors will realize that this branch of science demands a full knowledge of minerals and the laws of their deposition and that it must be supplemented by optical work on the transparent gangue materials.

It is safe to say that metallography applied to ores has immensely widened our conceptions of the successive

metasomatic changes which constantly take place in the metallic minerals and brought the realization that a large number of doubtful minerals are nothing but mixtures. The geologist will find in this method a key to the succession of events in an ore deposit, and the mining engineer will easily ascertain why some of his ores are difficult to treat or to concentrate. Some questions, long in doubt, such as how silver is contained in galena, have been readily solved. In delicacy and power the method is much superior to that based on the study of thin sections, and our knowledge of ore deposits is just beginning to profit from this new line of investigation.

BY THE WAY

The tungsten boom is responsible for the latest form of embezzlement. On May 26 Mike Bernstein was arrested in Salt Lake City on a warrant charging him with the "embezzlement of tungsten ore valued at $3,000." Three hours after being notified by Sheriff Crane, of Ely, Nev., Deputy Sheriff Penrose arrested his man in Salt Lake City, after having found one sack of the ore consigned to Bernstein at the Wells Fargo express office.

Dr. John Grant Lyman, widely known for his mining-stock promotions, was found guilty in the United District Court, New York, June 7, of using the mails to defraud in connection with the operation of a brokerage concern under the name of John H. Putnam & Co., after the jury had deliberated 15 minutes. He was sentenced to 18 months in the Federal Prison at Atlanta. The trial lasted nine days and Lyman was his own lawyer. He is also under eighteen months' sentence in California.

The Attorney General of the United States is considering whether he ought once more to proceed against the Standard Oil companies on the ground that the dissolution ordered by the Supreme Court was carried out in name rather than in fact. The real reason is that the price of gasoline has risen to a high level, which is the subject of a great deal of complaint in Henryford territory. The proper action to be taken against the several oil companies is to compel them to sell gasoline to owners of $1,000 cars at 10c. per gal., while the owners of big cars should be charged 40c. Another satisfactory expedient would be to compel owners of oil stocks to surrender them for distribution among the consumers of gasoline. These are the only ways of curing the gasoline trouble that we can think of, unless people will refrain from using so much of it.

Actual figures, appearing in the *Financial Chronicle*, showing the increases which great industrial concerns have made in the number of their employees, would doubtless be even more startling, says the *Evening Post*, if increases in wages were also shown. One concern alone, E. I. du Pont de Nemours and Co., augmented its labor force from 5,300 in October, 1914, to 62,200 in December, 1915, an increase of 1,070%. Increases in other large industrial companies are not so startling; but they are none the less instructive, if only because they are more representative. The Steel Corporation, which averaged 180,000 employees during 1914, had 227,000 in December, 1915. Bethlehem Steel enlarged its force from 15,600 to about 22,000. The Westinghouse companies, employing 18,300 men in March, 1915, had 31,600 in March this year. Western Electric showed an increase of 10%, and General Electric of 20%.

An official notice issued by Juan T. Burns, Mexican Consul General in New York, appears in the New York *Times*, June 9. The advertisement reads:

> **The Mexican Consulate General of New York.**
> **To the Mexican Residents.**
> **Important Notice.**
>
> **I wish to remind all the Mexican residents of the States of New York, New Jersey, Connecticut, Massachusetts, New Hampshire, Rhode Island and Maine, which are under the jurisdiction of this Consulate, that it would be advisable for them to call at the offices of the Consulate and register, according to the regulations of the law.**
>
> **JUAN T. BURNS, Consul General.**

Señor Burns, when seen at the Consulate General at 120 Broadway, said there was nothing extraordinary attached to the insertion of the notice. "It is simply the carrying out," he said, "of a regulation of the Mexican government which has long been in force. Similar regulations are observed by other countries. I can assure you that there is no military reason for the action we are taking."

Speaking about the depreciation of currency in Mexico, Samuel G. Blythe tells in the *Saturday Evening Post* of the experience of a mine owner that he knew. He closed down and came out early in the troubled period, leaving cyanide valued at $6,000 gold, in a warehouse in Vera Cruz. He owed in Mexico, to Mexicans mostly, considerably more than 300,000 pesos, which, with pesos worth 40c., gold, as they were at that time, made his debt some $120,000, gold. The European War came along. Cyanide rose in value. He made a killing. He sold his cyanides for $17,000 dollars, gold. With that $17,000 he bought Carranza money at $1.90 a hundred pesos, or less than 2c. a peso. Inasmuch as it has been decreed by First Chief Carranza that Carranza money must be accepted at par by Mexicans in payment of all obligations of this sort, this man paid off a debt that really amounted to $120,000, gold, for $17,000, gold, by converting that $17,000 into Carranza pesos and discharging his indebtedness with those. The Mexicans had to take the 2c. money at its face value. The First Chief had decreed that. If they refused it, they were guilty of treason to this magical creator of fiat values.

The death of the old *Territorial Enterprise* at Virginia City on June 1, the first newspaper published in Nevada and one of the most famous journals of the West in its wild days, now merged with the Virgina City *Chronicle*, recalls a deal of history of the great days of the Comstock, says the San Francisco *Chronicle*. Mark Twain first assumed that pen name as a local writer on the *Enterprise*. Into its history also comes Rollin M. Daggett, who established the *Golden Era* and the *Mirror* in San Francisco, Judge C. C. Goodwin, Dan de Quille and Senator William Sharon. It was in 1862 that Samuel L. Clemens came to the *Enterprise* as a reporter. Before that time he had written a number of leters to it from Aurora, in Esmeralda County, signing them simply "Josh." He had not then thought of the name "Mark Twain." When he first came to the *Enterprise*, all hands called him "Josh." He did not like the name and in casting about for a better one hit upon the sobriquet "Mark Twain," digging that

up from his old days on the Mississippi River. His fellow reporter on the *Enterprise* was Dan de Quille, otherwise William Wright, who remained for many years as local editor of the paper and whose humor was familiar to magazine readers of a generation ago. The old *Enterprise* office was a plant complete even to its dining room and kitchen, with the Chinese cook, "Old Joe." "The old Chinaman," says Dan de Quille, "was long thought to be the boss cook of the town. This was chiefly for the reason that he was able to place the butter on the table molded into the form of lions, dragons and the like. So much was said in praise of Joe's lions, tigers and dragons that he finally gave most of his time to the modeling of such works of art. Presently mouse hairs began to be found in the biscuits every morning, and flies and bugs in other articles of food. An investigation brought to light unpleasant discoveries and Joe was fired by acclamation. Other Chinamen followed, but as all hands were now constantly on the watch for faults in the cookery, none remained long, and presently cooking in the office was discontinued and the employees dispersed to try their luck among the restaurants."

Appraisement of Imported Zinc Ore

The Treasury Department has altered its regulations for the appraisement of the value of imported zinc ores. The new method of ascertaining the value of zinc in imported ore under the provisions of paragraph L of section 3, tariff act of 1913, based upon the selling price of zinc in the United States, published by the Treasury Department, June 3, 1916, as T. D. 36446 is as follows:

To appraisers of merchandise and others concerned:

The following method will be followed by appraising officers in determining the value of zinc in imported ore arriving in the United States after July 1, 1916:

(1) From the ascertained assay deduct 8 units for sulphide and 6 units for nonsulphide ores. The remainder will represent percentage of recoverable zinc in the ore, which multiplied by 2,000 will give the number of pounds of zinc recoverable from a ton of ore.

(2) Multiply the result as above ascertained by the average price of prime western spelter in East St. Louis for the week in which the ore was exported; that is, the week including the date of sailing of the ship or day the car leaves the foreign country. This will give the gross value of the zinc in the ore at the time of its exportation.

(3) Deduct from the gross value of the zinc in the ore as above ascertained the following:

(*a*) The freight actually paid from the foreign mine to the domestic smelter receiving same in the United States.

(*b*) The insurance actually paid.

(*c*) The actual shipping charges.

(*d*) Foreign export duties and charges, if any.

(*e*) Treatment charge (as explained in par. 4).

(*f*) Penalties for iron, as stipulated in paragraph 5.

(*g*) Duty on lead contents, if any.

(*h*) Duty on zinc.

(4) Treatment charge. (*a*) For sulphide ores the treatment charge will be ascertained as follows: From the value of the recoverable spelter in a ton of 2,000 lb. medium grade Joplin sulphide ore, 60% base, deduct the average of the quoted prices for such ore and $1.50 per ton of 2,000 lb. as representing the average freight on Joplin ores from Joplin, Mo., to common Kansas smelting points.

(*b*) For nonsulphide ores the treatment charge will be ascertained as follows: From the value of the recoverable spelter in a ton of 2,000 lb. of 40% calamine ore deduct the average of the quoted prices for such ore and $1.50 per ton of 2,000 lb. as representing the average freight paid from Joplin, Mo., to common Kansas smelting points.

(5) Penalties.—On iron ore deduct penalties as follows: $1 on each unit of iron in excess of 1% up to and including 6%; 50c. per unit on each unit of iron in excess of 6% up to and including 12%; 25c. for each unit of iron in excess of 12%.

(6) The average market price of Joplin zinc ore and prime western spelter to be taken in accordance with quotations contained in the *Engineering and Mining Journal* for the calendar week including the date of the sailing of the ship or day the car leaves the foreign country.

(7) Recoverable spelter, wherever that term is used in this memorandum, means for sulphide ores the assay minus 8 units, and for nonsulphide ores the assay minus 6 units.

EXAMPLE: SULPHIDE ORE

Assume: Assay 48% zinc, 6% lead, 14% iron; freight mine to smelter, $13 per ton of 2,000 lb.; insurance, $1.50 per ton; loading and expenses, $1 per ton; prime Western spelter, 15c. per lb.; medium grade Joplin ore, 60% base, $100 per ton.

48% — 8% = 40% × 2,000 lb. = 800 lb. at 15c.			$120.00
Deductions:			
Freight, mine to smelter	$13.00		
Insurance	.50		
Loading and expense	1.00	$14.50	
Penalties:			
14% — 1% = 13%:			
5% at $1.00	$5.00		
6% at .50	3.00		
2% at .25	.50	8.50	
Treatment:			
60% — 8% = 52% × 2,000 = 1,040 at 15c.	$156.00		
Ore quotation	$100.00		
Freight to smelter	1.50		
	101.50	54.50	
Lead, 2,000 lb. × 6% = 120 lb. at ¾c.		.90	78.40
			$41.60

$41.60 ÷ $1.10 = $37.82 dutiable value.

EXAMPLE: NONSULPHIDE ORE

Assume: Assay 36% zinc, 3% lead, 2% iron; freight, mine to smelter, $10 per ton of 2,000 lb.; export duty, $1; prime Western spelter, 15c. per lb.; Joplin calamine, 40% base, $50 per ton.

36% — 6% = 30% × 2,000 lb. — 600 lb. at 15c.			$90.00
Deductions:			
Freight, mine to smelter	$10.00		
Export duty	1.00	$11.00	
Iron penalty, 2% — 1% = 1% at $1		1.00	
Treatment:			
40% — 6% = 34% × 2,000 lb. = 680 lb. at 15c.	$102.00		
Ore quotation	$50.00		
Freight to smelter	1.50		
	51.50	50.50	
			62.50
			$27.50

$27.50 ÷ $1.10 = $25 dutiable value.

Owing to the fact that the several factors necessary to determine the market value or purchase price of zinc ores are usually not known at the time of shipment, and importers cannot ascertain the value of the zinc in the ore, collectors are authorized to permit entry by appraisement of zinc-bearing ores.

ANDREW J. PETERS,
Assistant Secretary.

NEW PUBLICATIONS

MINERAL RESOURCES OF THE UNITED STATES, 1914. Part I, Metals; Part II, Nonmetals. H. D. McCaskey, Geologist in Charge. 5½x9, pp. 995 + 1122, illus. U. S. Geological Survey, Washington.

DICTIONARY OF ALTITUDES IN THE DOMINION OF CANADA. (Second Edition.) By James White. 6½x9½, pp. 251. Canadian Commission of Conservation, Ottawa.

MISSISSIPPI, ITS GEOLOGY, GEOGRAPHY, SOILS AND MINERAL RESOURCES. By E. N. Lowe. Pp. 335, illus. Bull. 12, Mississippi State Geological Survey, Jackson.

THE NEW ZEALAND OFFICIAL YEAR BOOK, 1915. By Malcolm Fraser, Government Statistician. 5¼x8¼, pp. 1,004, illus. John Mackay, Government Printer, Wellington, New Zealand.

ANALYSES OF COAL SAMPLES FROM VARIOUS PARTS OF THE UNITED STATES. By Marius R. Campbell and Frank R. Clark. Pp. 120, Bull. 621-P, U. S. Geological Survey, Washington.

GEOLOGY AND GEOGRAPHY OF THE GALENA AND ELIZABETH QUADRANGLES. By Arthur C. Trowbridge and Eugene Wesley Shaw. HISTORY OF DEVELOPMENT OF JO DAVIESS COUNTY. By Bernard H. Schockel. Pp. 233, illus. Bull. 26, Illinois State Geological Survey, Urbana, Ill.

UNITED STATES STANDARD BAUMÉ HYDROMETER SCALES. Pp. 13. Issued Apr. 5, 1916. Circular No. 59, U. S. Bureau of Standards. Department of Commerce, Washington.

STANDARD DENSITY AND VOLUMETRIC TABLES. Pp. 67. Issued Mar. 30, 1916. Circular of Bureau of Standards, No. 19. Department of Commerce, Washington.

REPORT OF BRITISH DEPARTMENT COMMITTEE ON THE DANGER IN THE USE OF LEAD IN THE PAINTING OF BUILDINGS. Pp. 207. Bull. No. 188, March, 1916, U. S. Bureau of Labor Statistics, Washington.

ORE DEPOSITS OF THE BEAVERDELL MAP-AREA. By Leopold Reinecke. Pp. 178, illus. Memoir 79, Canadian Department of Mines, Geological Survey Branch, Ottawa.

GEOLOGY OF FIELD-MAP AREA, B. C., AND ALBERTA. By John A. Allan. Pp. 312, illus. Memoir 55, Department of Mines, Geological Survey Branch, Ottawa.

REPORT OF THE TENTH ANNUAL CONFERENCE ON WEIGHTS AND MEASURES, May 25-28, 1915. Pp. 254, illus. U. S. Department of Commerce, Bureau of Standards, Washington.

THE PHYSICAL GEOGRAPHY OF WISCONSIN. By Lawrence Martin. 6½x9½, pp. 549, illus. Bull. XXXVI, Wisconsin Geological and Natural History Survey, Madison, Wis.

SUMMARY REPORT OF THE GEOLOGICAL SURVEY, DEPARTMENT OF MINES FOR THE YEAR, 1915. Pp. 307, illus. Sessional Paper No. 26, Canadian Department of Mines. Geological Survey Branch, Ottawa.

GEOLOGY AND ORE DEPOSITS OF ROSSLAND, BRITISH COLUMBIA. By Charles Wales Drysdale. Pp. 317, illus. Memoir 77, Canadian Department of Mines, Geological Survey Branch, Ottawa.

DIRECTORY OF THE IRON AND STEEL WORKS OF THE UNITED STATES AND CANADA. Eighteenth edition, corrected to Jan. 1, 1916. Compiled by the Statistical Department of the American Iron and Steel Institute. 5½x8¼; pp. 440; cloth. The American Iron and Steel Institute, New York. Price, $12.

The preparation of a directory of iron and steel works was one of the first labors undertaken by the late James M. Swank when he became the executive officer of the old Iron and Steel Association. The first edition appeared in 1873, and in all 17 editions and two supplements appeared under Mr. Swank's editorship. The latest edition was dated in 1908, although two supplements have appeared since that year. The growth of the steel trade since that time has been so great that these supplements have been insufficient to cover it, and a new edition was urgently needed. It is hardly necessary to say that the earlier editions showed the industry, accuracy and good judgment which characterized Mr. Swank's statistical work, and that the directories have been of great service to all interested in the trade, in fact really indispensable.

An important change has been made in the general arrangement of the directory. In the first edition the data of the various industries were arranged by geographical districts. In view of the fact that the industry 40 years ago depended largely upon local ore and fuel supplies, this was a wise and almost necessary arrangement. This plan was followed in the later editions; but with the growth of the industry and the improvement in transportation methods, the motive and reason for a geographical classification gradually disappeared. For similar reasons, including also the broadening of ownership, the classification under blast furnaces, rolling mills, etc., has also lost its motive.

In the new volume the names of all companies, firms and individuals making pig iron, wrought iron, steel and their finished products are given in alphabetical order, regardless of location, and can thus be easily found without the aid of an index. Under each name is given a condensed description of the plant or plants owned. In addition to these lists a supplement of 70 pages gives lists of blast furnaces, steel converters, rolling mills and other finishing plants. These are simply lists, descriptions of the various plants having been given in the main section, and are rather in the nature of a classified index, which may often be convenient for reference.

So far as a preliminary examination can show, the work has been carefully and completely done. This latest edition is a worthy continuation of the admirable work of Mr. Swank and reflects much credit upon Howard H. Cook, assistant secretary of the institute, William G. Gray, the head of its statistical bureau and other members of the institute staff.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

AMALGAMATOR—Electrochemical Amalgamator. Samuel S. Rose, San José, Calif. (U. S. No. 1,186,335; June 6, 1916.)

CLAYS—Art of Refining Kaolin and Similar Clays for Use in Making Pottery and Like Products. William W. Simonson, Cincinnati, Ohio. (U. S. No. 1,185,254; May 30, 1916.)

CRIMPING DEVICE—Miner's Tool. Ole Hanson, Lead, S. D. (U. S. No. 1.184,746; May 30, 1916.)

CRUSHING—Method of Making Stamp Shoes. Francis S. White, Philadelphia, Penn. (U. S. No. 1,186,055; June 6, 1916.)

CRUSHING—Pulverizer-Mill Yoke and Pusher. Walter S. McKee, Chicago, Ill., assignor to American Manganese Steel Co., Chicago, Ill. (U. S. No. 1,186,214; June 6, 1916.)

DRILL. Blaine Jenkins and Toy C. Hayes, Leona Mines, Va. (U. S. No. 1,185,803; June 6, 1916.)

DRILLS—Improvements in Rock Drills. F. E. Kewley and J. A. Corner, Bristol, Eng. (Brit. No. 7,709 of 1915.)

DRILLS—Support for Coal and Rock Drills. Nils D. Levin, Columbus, Ohio, assignor to The Jeffrey Manufacturing Co., Columbus, Ohio. (U. S. No. 1,185,809; June 6, 1916.)

FURNACES—Improvements in Furnaces. W. W. Crawford. London, England. (Brit. No. 2,481 of 1915.)

FURNACE. William M. Kelly, Anaconda, Mont. (U. S. No. 1,186,104; June 6, 1916.)

GAS-ANALYZING APPARATUS. Henry Leland Lowe, Pittsburgh, Penn. (U. S. No. 1,186,014; June 6, 1916.)

GOLD-SAVING APPARATUS. Ernest H. Gagnon, Billings, Mont. (U. S. No. 1,186,304; June 6, 1916.)

HYDROMETALLURGY — Process of Extracting Metals from Their Ores. William E. Greenawalt, Denver, Colo. (U. S. No. 1,186,306; June 6, 1916.)

LAMP—Miner's Electric Lamp. Angelo Toler, Berwind, Colo. (U. S. No. 1,186,454; June 6, 1916.)

MALM PROCESS—Process of Treating Metal and Mineral-Bearing Materials. John L. Malm, Denver, Colo. (U. S. No. 1,185,817; June 6, 1916.)

MELTING FURNACE. Alexander W. Carroll, Elizabeth, N. J. (U. S. No. 1,182,893; May 16, 1916.)

METAL-COATED IRON OR STEEL ARTICLE. Clarence Mark and Clayton Mark, Jr., Evanston, Ill., assignors to Clayton Mark, Chicago, Ill. (U. S. No. 1,186,217; June 6, 1916.)

MINE-LOADING MACHINERY. Frank Billings, Cleveland, Ohio. (U. S. No. 1,185,050; May 30, 1916.)

MINER'S PICK. John W. Shallenberger, Canal Fulton, Ohio. (U. S. No. 1,186,343; June 6, 1916.)

NITROGEN—Fixation of Nitrogen. Edgar Arthur Ashcroft, London, England. (U. S. No. 1,186,367; June 6, 1916.)

STEEL—Manufacture of Steel. Harry E. Sheldon, Pittsburgh, Penn. (U. S. No. 1,185,252; May 30, 1916.)

STEEL SCRAP—Process of Melting Steel Scrap. Albert E. Greene, Chicago, Ill. (U. S. No. 1,185,395; May 30, 1916.)

SULPHIDE ORES—Process of Treating Ores Containing Lead. Royal S. Handy, Kellogg, Idaho. (U. S. No. 1,185,902; June 6, 1916.)

SULPHURIC ACID—Process for the Manufacture of Sulphuric Acid. William H. Waggaman, Washington, D. C. (U. S. No. 1,185,092; May 30, 1916.)

TAPPING HOLES—Method of Opening Hard or Frozen Tapping Holes. Henry Charles Witz, Johnstown, Penn. (U. S. No. 1,186,358; June 6, 1916.)

TITANIC ACID—Method for Obtaining Titanic Oxide. Auguste J. Rossi, Niagara Falls, N. Y., assignor to Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,184,131; May 23, 1916.)

TUNNELING MACHINE. Carl W. Hodgson, Denver, Colo. (U. S. No. 1,185,797; June 6, 1916.)

ZINC—Process of Preparing Pure Zinc-Sulphate Solution from Zinc Ores. Shunjiro Araki, Osaka, Japan. (U. S. No. 1,185,757; June 6, 1916.)

ZINC—Process of Smelting Materials Containing Zinc or Other Volatile Metal. J. M. Hyde, Berkeley, Calif. (Brit. No. 2,221 of 1915.)

PERSONALS

M. L. Child, recently at Lake City, Colo., in now in Boston.

L. W. Kemp, recently in Chile, is now at Grass Valley, Calif.

M. S. Griffiths is now at Island Mountain, Trinity County, Calif.

W. E. Simpson is developing a molybdenite property near Amos, Quebec.

Henry P. Smith, lately at Guanajuato, Mexico, is now at La Jolla, Calif.

O. G. Engelder, recently in the Island of Sardinia, is now in Hoboken, N. J.

F. Lynwood Garrison sails for Brazil June 17 to be gone three or four months.

Heath Steele has gone to Bonne Terre, Mo., to make some professional investigations.

T. B. Counselman, recently at the School of Mines, Minneapolis, Minn., is now at Duluth.

Thomas McGuckie is superintendent of the Sterling Coal Co., Ltd., at Drunheller, Alberta.

Charles F. Thompson, recently at Mattapan, Mass., is now at the Logan mill, Crisman, Colo.

Charles R. Vorck, recently at Golden, Colo., is now with the Bartlesville Zinc Co. in Oklahoma.

James S. Douglas is in the East attending college festivities, and making also a business trip.

Albert E. Hall, recently in New York, is now with the Sable River Copper Co., at Masset, Ont.

Hugh Rose, manager of the Santa Gertrudis at Pachuca, Mexico, is visiting at Williamstown, Mass.

Lindsey Duncan, lately with the Cie. de Boleo, at Santa Rosalia, Lower California, is now at McGill, Nev.

Robert E. Cranston left San Francisco, May 29, for Montana, to be in Butte and vicinity for several weeks.

E. B. Durham, lately at Salt Lake City, Utah, is now at Kennett, Calif., with the Mammoth Copper Mining Co.

F. Danvers Power has opened new offices in the Perpetual Trustee Chambers, Hunter St., Sydney, New South Wales.

A. W. Fahrenwald and **P. A. Ballard,** both of South Dakota, graduated from the New Mexico School of Mines, at Socorro.

John Seward is at Nutley, N. J., having returned from a trip of three weeks to Ontario to examine mining properties.

Russell A. Cowles, president of the Buffalo Copper and Brass Rolling Mills is director in the Kenefick and the United Zinc Smelting companies.

Stephen Birch, vice-president of the Alaska Development and Mineral Co. of New York, will be married June 24 to Miss Mary Rand, of Minneapolis.

B. Mattingly, recently with the Tonopah-Belmont Mining Co. in Nevada, is now at the Surf Inlet gold mine on Princess Royal Island, British Columbia.

H. P. Henderson will be in Boston next week to take part in the Harvard '01 Quindicennial celebration, and will shortly thereafter leave for Jerome, Ariz.

Charles Warren Hunt, of New York, secretary of the American Society of Civil Engineers, recently visited San Francisco and other points in California.

R. C. Steese, vice-president and general manager of the Brier Hill Steel Co., Youngstown, Ohio, has resigned. He will continue a member of the board of directors.

W. M. Brewer, of Victoria, B. C., will spend the field season of this year investigating metal mines and conditions on Vancouver Island for the British Columbia Department of Mines.

F. W. Humbert, who has been manager of mines for the Low Moor Iron Co. of Virginia, has been made general manager. Mr. Humbert is also on the U. S. Naval Consulting Board.

G. G. S. Lindsey, past president of the Canadian Mining Institute, who has been for two years past in China, has practically completed his work there and is on his way to London.

R. J. Webster, manager of the Standard Oil Co. of Calcutta, and **Joseph J. Carey,** assistant manager of Standard Oil Co. at Saigon, French Indo-China, have returned to San Francisco.

E. M. Rabb, recently superintendent of the Tennessee mine, Chloride, Ariz., for the United States Smelting, Mining and Refining Co., is now manager of the Tom Reed Gold Mines Co., at Oatman, Ariz.

Daniel Harrington of the Bureau of Mines is in Butte, Mont., where he will, in company with Dr. Lanza of the Public Health Service, make an investigation of health conditions both surface and underground.

Samuel W. Cohen, general manager of the Crown Reserve Mining Co., Ltd., and the Porcupine-Crown Mines Ltd., has returned to Cobalt, Ont., after a two months' examination trip through Idaho, Oregon and California.

Rodolphe L. Agassiz, late vice-president, has been chosen president of the Calumet & Hecla Mining Co. That office has been vacant for over a year. **James MacNaughton,** late second vice-president, has been chosen vice-president.

J. C. Devine, who for over 10 years has been connected with the Ray Consolidated Copper Co. as underground superintendent of mines, resigned his position to take up the active management of the Pinal Development Co., of Arizona.

E. C. Hutchinson, of San Francisco, president of the Kennedy Mining and Milling Co., recently visited southern California, including the Pan-California Exposition at San Diego, where a moving picture of the Kennedy mine is exhibited.

W. J. Loring has returned to San Francisco from a visit in Boston and New York in connection with the Dutch-Sweeney-App mines in Tuolumne County, Calif., and a large number of mining claims in Calaveras County which he is preparing to develop.

Theo. C. Denis is on his way from France to Canada to resume his duties as superintendent of mines of the Province of Quebec. The French Government released him from his obligation to military service at the request of the Government of Canada.

John C. Devine, assistant superintendent since 1906 at Ray Consolidated Copper Co., has resigned to devote his attention to the development of the Renfro property of the Pinal Development Co., of which he is president. **Charles H. Smith** succeeds Mr. Devine at Ray.

Louis N. McDonald has been appointed assistant general superintendent of the Carnegie Steel Co. in place of John Hughes, who is now assistant to the president of the U. S. Steel Corporation. He has been for some time superintendent of the Ohio district of the company.

The Board of Trustees of Stanford University has adopted resolution of appreciation for the services rendered by David Starr Jordan, who was the first president of Stanford, was recently made chancellor and now carries the title of chancellor emeritus, having been retired from active duty.

Upon request of the Bureau of Mines, a committee of the **American Chemical Society** has been appointed as an advisory committee to the Bureau of Mines on chemical problems in connection with its investigations. The committee consists of Drs. C. H. Herty, L. H. Baekeland and W. R. Whitney.

G. A. Joslin is in Boston taking part in the Technology reunion. He will be in New York June 15-19 at the Hotel Manhattan and will then return to Kansas City, where he is at present engaged in directing the mineral examinations and explorations of the Dierks Lumber and Coal Co., in Arkansas and Oklahoma.

G. H. Cunningham, superintendent of construction for electrolytic zinc plant, Washoe Reduction Works, Anaconda, Mont., has recently been appointed construction engineer in charge of installation of equipment in the new 100-ton electrolytic zinc plant, which the Anaconda Copper Mining Co. is building at Great Falls.

John R. Stanton is first vice-president of the Non-Commissioned Officers' Volunteer League of America, a permanent organization formed with the ambitious purpose of maintaining permanent barracks in 10 of the largest cities in the country for the training of "non-coms." The permanent office is at 42 Broadway, New York.

The **Standing Committee on Metallurgy** appointed by the British Advisory Council for Scientific and Industrial Research consists of the following members: Prof. J. O. Arnold, Mr. Arthur Balfour, Prof. H. C. H. Carpenter, Dr. C. H. Desch, Sir Robert Hadfield, F. W. Harbord, J. Rossiter Hoyle, Professor Huntington, W. Murray Morrison, Sir Gerard Muntz, G. Ritchie, Dr. J. E. Stead, H. L. Sulman and F. Tomlinson.

C. A. Waring and **E. Huguenin,** field assistants of the California State Mining Bureau, have been engaged in visiting the Death Valley region, including all the active mining

camps and thence into northern Inyo County, attracted by the tungsten discovery near Bishop. They report that Keane Wonder and Skidoo are both busy and that Ryan, the terminal station on the branch line of the Tonopah & Tidewater, has become a mining center. Ryan is about 15 mi. northeast of Greenwater.

At the **Tom Reed Mine,** Arizona, the entire management changed on June 1. The resignation of the superintendent, S. S. Jones, the assistant superintendent, Dr. J. M. Francis, the mine foreman, Wm. Flanigan, the mining engineer, J. D. Sperr, and the master mechanic, A. W. Harris, took effect on June 1. The new management has been on the ground for the past two weeks getting acquainted with the workings. Practically the entire new crew are former employees of the U. S. Smelting, Refining and Mining Co.'s Gold Road mine.

Harrison A. Dunn, chief engineer of Tramways Co., Mexico, D. F., is reported to be languishing in prison in the Mexican capital. **Howard L. Francis,** also an engineer of the Tramways Co., recently arrived in New York, is quoted as saying that unsuccessful efforts were made to secure trial for Mr. Dunn, although appeal was made to the American diplomatic representative, Mr. Rogers. Mr. Dunn is a graduate of the Michigan College of Mines, 1909, and was formerly manager of the South Live Oak Development Co. at Miami, Ariz.

Following on the appointment of **D. H. McDougall** as general manager of the Dominion Steel Corporation, and the extension of his duties to include the general managership of the Dominion Iron and Steel Co. in addition to the position of general manager of the Dominion Coal Co., there have been several new appointments at the mines. Alfred J. Tonge has been appointed general superintendent of mines, in addition to his former duties as mining engineer. J. D. Maxwell, has been promoted from the position of district superintendent of No. 2 district to be assistant general superintendent of mines, and Alex. S. McNeill, formerly manager of No. 2 colliery, is appointed superintendent of No. 2 district.

OBITUARY

Frank Graham, well known as a mine operator and mill manager in the Georgetown district in Colorado, was killed May 17 at the Mendota mine by a fall of rock while he was superintending retimbering.

Capt. James H. Polglase, of Iron River, Wis., died recently in Chicago, following an operation. He was 48 years of age and a native of Cornwall, England. Upon arriving in the United States he went to work in the mines at Ishpeming, Mich., going later to the Mesabi range, where he was made captain of several properties. His headquarters were in Virginia, Minn. When the Davidson Ore Co. entered the Iron River field, Captain Polglase was placed in charge of the mines. He held that position until a few years ago, when he retired to engage in the mercantile business. He was well known throughout the iron districts.

William Haas died in San Francisco, May 31, of heart failure. Mr. Haas was 67 years old, born at Reckendorf, Germany, and came to America, arriving at San Francisco in 1865. As the head of the firm of Haas Bros. he was director of the agency which that firm controlled for the sale of quicksilver. For several years the Eureka Co., a quicksilver selling agency or pool, controlled the purchase and sale of quicksilver in California and Nevada. Mr. Haas was prominent as a director and part of the time president of the Eureka Co. Indirectly or directly, he was connected with the New Idria Quicksilver Mining Co. and remained its selling agent after the dissolution of the Eureka company.

SOCIETIES

Indiana University—The fourth season of the summer school of field geology began June 15, under the direction of Dr. J. W. Beede. The party will continue the study of the Clay City, Indiana, quadrangle. This is regular work in geologic surveying, including the mapping of the stratigraphic and economic geology, the study of the paleontology, physiography and geography of the quadrangle.

Lake Superior Mining Institute—Jan. 20, 1917, has been set as the opening date for the next annual meeting of the Institute. The members will go to Birmingham, Ala., to inspect the mines and mills of that place, with a side trip to New Orleans. It will be impossible to hold a meeting this summer, as the mining men are too busy to leave their work. Most of them can get away in the winter, when many of the mines are idle or not working to capacity. It is difficult for them to leave their work during an active shipping season.

Colorado School of Mines—President Phillips of the school at Golden, Colo., announces the following appointments to take effect Sept. 1: George J. Young, now Professor of Mining Engineering, University of Minnesota, to the professorship of Metallurgy; Claude C. Van Nuys, now Professor of Physics, South Dakota School of Mines, to the professorship of Physics; Carroll G. Dolman, now principal of the High School at Monte Vista, Colorado, to the assistant professorship of English and Foreign Languages; Fred. G. Carter, University of Wisconsin, to be athletic director.

American Mining Congress—A New Mexico chapter has been organized at Silver City with approximately 100 members to start with. The officers are: John M. Sully, of Santa Rita, first governor; Thos. H. O'Brien, of Dawson, first vice-governor; George H. Utter, Silver City, second vice-governor; E. M. Sawyer, Tyrone, third vice-governor; T. L. Lowe, Silver City, treasurer; Don Lusk, Silver City, secretary. The directors for the first year are: C. T. Brown, T. H. O'Brien, E. D. Tittman, W. G. McDonald, Gregory Page, L. B. Prince, John M. Sully, A. T. Kirk, J. A. Mahoney, E. Fraser-Campbell, Geo. A. Kaseman, J. L. Lawson, J. M. Palmer, J. M. Vigil, E. A. Miera, Chas. A. Spiess, Geo. H. Utter, and E. M. Sawyer.

Maryland Geological Survey will have a number of parties in the field during the summer gathering data for systematic reports on the Silurian and Carboniferous formations, economic reports on the coals and fire clays, and on the underground waters. The following instructors and graduate students of the Geological Department will be engaged in this work: Professor Swartz and Dr. H. Bassler will be in the Silurian and Carboniferous region of western Maryland. G. M. Hall will be at work gathering materials for a report on the fire clays of the state. W. A. Baker will gather data regarding the equipment of the coal-operating companies for a report on the Coals of Maryland. J. P. D. Hull will spend part of the summer mapping the soils of Howard County and the balance in working on the geology of the Piedmont area of the same county. H. Insley will work on the Piedmont area of Harford County and on the underground waters of the northeastern tier of Piedmont counties. D. G. Thompson will work on the underground waters of portions of central and western Maryland.

American Iron and Steel Institute—At the 10th general meeting in New York, May 26 and 27, Judge E. H. Gary made a presidential address which was a careful study of present and possible future conditions in the steel trade. An address was made by Edward N. Hurley, vice-chairman of the Federal Trade Commission, on "Modern Business Conditions." The handling of raw materials was discussed in a paper on "The Distribution of Materials in the Blast Furnace," by George W. Vreeland, superintendent of blast furnaces, Carnegie Steel Co., Mingo Junction, Ohio. The advance in methods of converting the pig iron into finished products was covered in the paper by Dr. John A. Mathews, president, Halcomb Steel Co., Syracuse, N. Y., entitled "The Electric Furnace in Steel Manufacture," and in the paper on "Rail Manufacture," by Dr. John S. Unger, manager, central research bureau, Carnegie Steel Co., Pittsburgh. One of the varied uses to which finished products are put was the subject of Jacob Loewenstein's paper on "The Hell Gate Bridge." Mr. Loewenstein is engineer, American Bridge Co., New York.

INDUSTRIAL NEWS

F. R. Blair, formerly secretary-treasurer and sales manager of the S. K. F. Ballbearing Co., has resigned and has become president of F. R. Blair & Co., Inc., with offices at 50 Church St., New York.

G. H. Stephens, until recently vice-president and eastern manager of Stephens-Adamson Manufacturing Co., Aurora, Ill., has retired from active business on account of ill health. Mr. Stephens has been prominent in the conveying industry for 25 years and has enjoyed a wide acquaintance among machinery users of the East.

The American Manganese Steel Co., Chicago, has found it necessary to provide increased manufacturing facilities, and has therefore purchased the plant of the Brylgon Steel Casting Co., at New Castle, Del. This is a large, uptodate steel foundry, having a monthly capacity of approximately 400 tons of steel castings. The company now has two plants at New Castle, Del., and one plant at Chicago Heights, Ill. The task of converting the newly acquired plant into a manganese steel foundry of the latest and most efficient type is progressing rapidly, and it is expected to be producing next month.

Editorial Correspondence

SAN FRANCISCO—June 8

The Penn Mining Co. at Campo Seco has won in six of the 37 smoke suits filed against it by a firm of attorneys acting for certain farmers in Calaveras County. The hearing of 11 more of these cases is set for Sept. 5.

Mines of the Death Valley Region are more active than usual this year, spring and summer ordinarily being the dull season on the desert. South of Beatty, a station on the Tonopah & Tidewater R.R., it is estimated there are 450 men steadily employed by the various mining companies. The Tecopa has finished its 75-ton mill, and in addition to concentrates, is shipping 35 tons daily of crude ore. It is reported that this company has opened a rich orebody 12 mi. east of Tecopa. The Gunsite and Noonday are said to be keeping up a normal output. The Ibex zinc mine at Zabriskie, is reported to have been acquired by the Goodsprings company and preparations being made to increase the output. This company is putting on motor trucks for hauling ore. The manganese mine at Owls Head was sold recently by Alexander Yeoman to the Mollett Development Co. of Massillon, Ohio. This company has installed two 30-ton Holt tractors of the caterpillar type for hauling ore 27 mi. to the railroad at Riggs. One of the Riggs properties at Baker, 40 mi. north of Ludlow, is shipping 3 cars of silver-lead ore a week. The Pacific Coast Borax Co. roaster at Death Valley Junction is running to full capacity. In fact the entire region tributary to the Tonopah & Tidewater R.R. is prospering.

Mining Engineers of Nevada visited the Comstock mines on May 19, driving from Reno in automobiles. They were accompanied by Governor Emmett D. Boyle, of Carson, W. L. Saunders, of New York, and Charles Reuter, of San Francisco. Other members of the party were: Henry W. Rives, J. B. Racine, L. W. Hartman, J. C. Jones, E. L. Williams, H. K. Vernon, Robert Nye, of Reno; John W. Hutchinson, J. D. Brown, R. W. French, E. A. Snedaker, Goldfield; R. A. Hardin, Walter P. Dale, Jr., Aurora; John C. Moulton, Blair; Curtiss Burt, E. J. Shrader, Rockland; C. Weck, Mason; Lee D. Dugan, Gold Circle. Most of the visitors were accompanied by their wives or other members of their family. They were the guests of Superintendents Whitman Symmes and Thomas F. McCormick. After visiting the Mexican mill they went down the Union shaft and made a long tour of the lower levels; thence through the Mexican, Sierra Nevada, Ophir and Con Virginia. An informal luncheon followed the visit underground. Governor Boyle tendered the thanks of the visitors to the ladies of Virginia City, and Judge F. P. Langan on behalf of the Comstock operators extended their greetings in the brief speech in which he resented the published imputation that Virginia City and towns in the vicinity are among the "ghost" communities of the past; he stated that, on the contrary, the Comstock is operated by the same energy, inspiration and courage which animated the pioneers of a half-century ago.

DENVER—June 8

Tungsten Mining continues a leading topic at Silverton. The Dawn of Day, Ruby, Marshall, Wolframite, Clifford, Tungsten King and Adams mines are all being operated solely for this metal. The Sunnyside, Highland Mary, National Belle, St. Paul and Silver Lake mines are producing their usual quota of ores containing the other metals for which this district has been famous many years.

Vulcan Mines and Smelter Co. blew in its new furnace at Vulcan, Gunnison County, on May 18. This smeltery was built to handle sulphide ore from the Vulcan-Good Hope mine and to reduce it to a matte running approximately 25% copper with a small amount of gold and silver. Installation and management are under the personal supervision of C. H. Mace. Among prominent stockholders in this new company are Robert G. Ainsworth, well-known manufacturer of precision instruments, C. P. Mety and George E. Bermont, all of Denver. This property produces telluride of copper, the identity of which was discovered by Dr. Louis Weiss, of Gunnison, one of the owners; native tellurium also is found here in interesting crystals. Water pumped from the mine is heavily charged with copper sulphate from which 87% of the copper is recovered by precipitation.

Cripple Creek's Output for May was 84,150 tons of a gross value of $1,185,840 or an average value per ton of $14.09. Of this production, 52,300 tons had a value exceeding $20 per ton. The Isabella mine produced about 1,500 tons. The El Paso mine is credited with nearly 2,000 tons of a gross value of about $50,000. The Golden Cycle mill at Colorado City has, during the last few months, been gradually enlarging its treatment capacity from 1,000 tons per day until now it is treating 1,500 tons. This plant is handling heavy shipments of dump materials from the Elkton, Gold Coin, Gregory and Economic mines. The Portland company has recently granted numerous new leases to blocks of the Independence ground. Attention is being directed to the granite area on the western slope of Mineral Hill, northwest of the city of Cripple Creek, a steam hoisting equipment having been installed there by Colorado Springs men.

BUTTE, MONT.—June 8

Native Copper in the Tropic Mine, the new property of the Anaconda company at the extreme eastern edge of the Butte district, has attracted considerable interest. The native copper is found in minute particles embedded in masses of crushed and cemented quartz, occurring in large kidneys in the vein. The Tropic is shipping 150 tons per day, the ore being mined from the 500- to the 900-ft. levels. The Tropic is the most easterly producing mine in the district, and a short distance south of the Butte & London property now being developed by the Rainbow Development Co., a Cole concern, and the rich discovery is strengthening predictions made for the Butte & London, the shaft of which has reached the 1,600-ft. point where a level will be opened and the property explored north and south by crosscutting.

The Labor Situation, due to the strike of the members of the Workingmens' Union, has not thus far seriously interrupted the routine of local affairs. The first visible effect was the taking-off of street-car service throughout the town and outlying districts. This worked greatest hardship on miners living at a distance from their working places who were dependent on the street cars for transportation. The general public either walks or makes use of private autos and jitney busses. Over 2,000 men are now idle on account of the strike. The number will be swelled considerably by the walking out of the teamsters on June 12, when all unionized transportation will cease. Citizens have been laying in provisions and coal and the community seems determined to take a firm stand against the movement for higher prices. At a meeting of the Clerks' Union the other night no vote was taken on the motion to strike.

Several Accidents in Butte Mines last week attracted attention. A metal carbide lamp caused the death of A. Moran, a motorman's helper at North Butte company's Speculator mine, on June 6, while walking through a drift he stepped on a rail and at same moment the lamp touched the trolley wire overhead; efforts of first-aid department to revive him proved fruitless. The night before, at same mine, I. Gustafson fell down the shaft, having evidently fainted and fallen off the cage while being hoisted. Marshall Viz, a miner at the Anaconda company's Bell mine, on the same day was found in the sump of the Bell shaft; what caused him to pitch into the shaft has not been determined. On June 7, Mike Berkich, a miner working near the station on the 1,100 level of Anaconda's Moonlight mine, missed his footing and fell 600 ft. to the sump where his body was recovered by a searching party.

SALT LAKE CITY—June 9

Utah Was Third in Lead Production in 1915, according to figures collected by the U. S. Geological Survey. Missouri was first, with 195,634 short tons; Idaho second with 160,680 tons, and Utah next with 106,105 tons.

Sale of State School Lands was under consideration lately at a meeting of the state board of land commissioners and it was decided that no more such land, known or believed to contain mineral or coal deposits, will be sold by the State of Utah until the United States Supreme Court hands down final decision in the controversy over the right of the state to its school lands irrespective of their contents.

Chief Consolidated, originally organized with 100 acres of land at Eureka in the Tintic district, has since increased its

holdings to 4,500 acres, one-sixth of which is patented. Preparations are being made for sinking to depth on recently acquired ground in east Tintic. The shaft will be directly north of Homansville pumping plant. Eureka City Mining Co., organized several years ago to take over mineral rights under the Eureka townsite will soon be dissolved, as Eureka City Mining Co. stock has been turned in for exchange with Chief Consolidated. Property owners in Eureka townsite were given shares in Eureka City Mining Co., according to acreage. Chief Consolidated net earnings in April were $69,000 and May results were about the same. On May 1 there was about $370,000 in the treasury.

DOUGLAS, ARIZ.—June 9

American-Owned Mines in Mexico are threatened by the decree, No. 56, issued by Gen. P. Elias Calles, providing that the government may intervene and operate any mine in Sonora that is not in operation June 18, or which, after that date, is idle for a longer period than eight days. In the event of the government actually launching into the mining industry, it promises to turn over to the owners all profits remaining after all operating expenses, state and federal taxes are paid. But if the balance sheet should happen to show a loss, the owners would have to chip in for the deficit. The Carranza government has also issued a new decree, superseding the one of May 1, increasing the duty on all metals exported. Export duty on silver is increased from $2.54 per kg. to $4.97. On copper the duty is raised from 5c. to 9.28c. per kg. Similar increases apply to other metals. The decree goes into effect at once and the duties have to be paid in gold.

ST. LOUIS—June 12

Old Slag Piles at Bonne Terre, made in the early days when air-furnaces and scotch-hearths were employed, are being shipped to the Herculaneum smeltery as they are found to contain sufficient lead to warrant retreatment under present conditions.

Drilling in the Disseminated Lead Belt of Southeastern Missouri is very active. More diamond drills are now engaged than at any time in the history of the district. While some of this drilling is confined to development of present orebodies, considerable work of an exploratory nature is being done. The Baker Lead Co., of Boston, for example, has put two drills at work on the Turley tract, near Bonne Terre.

JOPLIN—June 10

The Hoistermen's Strike, which was started a week ago, is still under way but is not meeting with much success. A number of the larger mines are down, but in almost every case they are doing repair work and commonly declare that inability to get hoistermen is not the cause of their shutdown. At some mines there is talk of installing skip hoists, which will do away with the necessity for skilled hoistermen, but no actual move in this direction has been reported.

The Cisco Mining Co. has just completed one of the most modern plants in the district on a lease on the Royalty land south of Webb City. A skip hoist will be used and there will be an uptodate mill for ore and tailings under one roof. There are six jigs, 18 sludge tables, three Dorr thickeners, and other modern apparatus, including electric motors. Operations will be conducted at a depth of 255 ft., where there is an 18-ft. ore face that is expected to average 3% recovery in blende and galena. Gordon Battelle, son of Col. J. G. Battelle, of Columbus, Ohio, is the majority stockholder in the Cisco.

The Joplin Wage Scale in general use at present is one conceded by operators after the strike of about one year ago. While it has never been agreed to by the men acting as a union, because the operators never have recognized any union, it has proved generally satisfactory. It provides wages as follows when the average basis price of zinc ore is $50 to $60 for any month: Machineman, $3; powder man, $3.25; machineman (tripod), $3.25; machine helper, $2.50; boss shoveler, $3.25; trackman, $3; trackman helper, $2.50; mule driver, $2.50; bruno man, $2.50; pumpman, $2.50; tub runner, $2.50; pig tail, $2.50; roof man, $3. With each rise or fall in the price of zinc ore to an average price above $60 or below $50, an increase or decrease of 25c. per day for every $10 change is declared. The wage for shovelers varies at different mines, but the increases or decreases for them are made to approximate those for other workers.

A Zinc Ore Producers' Association has been organized in Joplin that has some semblance of permanency. Some of the larger producers are behind it. P. D. Butler has been made president, and a membership of approximately 100 has already been acquired. It is the intention of this organization to coöperate with the Safety and Sanitation Association which has been in existence for more than a year at Webb City, and it is also hoped to form other associating organizations in every camp in the district. One of the primary purposes is to get necessary information as to ore prices and market conditions. Another purpose is ultimately to establish an ore producers' bank, with a capitalization of $1,000,000, for the purpose of financing producers who wish to hold their ore. This is admittedly a big proposition and not likely of accomplishment immediately.

HIBBING, MINN.—June 10

A Record in Making a Producer from an openpit property will probably be made by Butler Bros., who are stripping the Lamberton mine, a Great Northern Iron Ore Properties' lease, near Hibbing. Stripping operations started a few days before Christmas and it is thought that the mine will be shipping about July 1, the period of development work thus being but a little over six months. The overburden varied in depth from 30 to 60 ft., being of the clay-and-boulder combination common to the Mesabi. The pit from which shipments will first be made will be about 600 ft. wide and about 700 or 800 ft. long. The equipment used in the work has been steam shovels, one of the Model 100-C Bucyrus and the other of Model 100 Marion type. There is the accompanying locomotive equipment now comprising two 55-ton locomotives and two locomotives of about 70 tons weight. The buildings accompanying the work at the mine have not been large and the spur track of the Great Northern R.R., which will carry the ore, is already laid. This constitutes what is probably the record in stripping a mine preparatory to shipments and is an illustration of the effect of the great demand for ore on certain operators on the Mesabi.

HOUGHTON, MICH.—June 10

White Pine Extension's Crosscut in the new shaft at 50 ft. has cut a promising copper formation, samples from which ran 100 lb. of copper per ton compared with 13 lb. indicated by the drill cores at this point. The showing is regarded as important as the shaft is a mile from the original exploration shaft and the drill cores showed copper-bearing rock all this distance. It is also important to recall that the drill cores were richer at greater depth.

"Air Blasts," it is believed, will not cause much further damage to the Quincy's working shafts. Some years ago when the situation was at its worst, Manager Lawton put into practice the plan of maintaining 200 ft. of rock surrounding each shaft opening as it went down. This required the maintenance of a great deal of valuable standing rock, near the shaft, but it "did the business," inasmuch as there have been no air blasts in any of the lower levels since that time. Every air blast has, on the other hand, occurred at a point half way from surface to the bottom and when damage has been done to the shaft proper it has happened where shaft pillars were particularly narrow. The reason for the hope that there will be no future trouble comes from the fact that Shafts 2 and 7 "came home," as the Cornish miners say, some time ago. And last month No. 6 shaft "came home" too, kicking up a little damage in getting in but not a fatality nor serious injury resulted. A rearrangement of the miners above the spot where the damage was done made it possible to maintain production at a figure nearly normal. The shaft was damaged somewhat for a distance of several hundred feet but has been quickly repaired.

TORONTO—June 8

To Encourage the Production of Potash which is greatly in demand for fertilizing purposes, etc., the Canadian Department of the Interior has issued new regulations regarding prospecting for salts of potassium in the western provinces and northwest territories. It is provided that mining rights for such minerals may be leased at 25c. per acre for the first year and at 50c. for subsequent years. As much as 1,920 acres can be leased by one applicant for a term of 21 yr. but specified improvements must be carried out.

The Rice Lake Gold District of Manitoba is creating considerable excitement in Winnipeg, and a rush to the locality is likely to ensue. Angus MacDonald, who has been working in this region for four years has arrived in Winnipeg with a quantity of high-grade samples from the Gold Pan mine, some of which are stated to show 80% gold. Last fall MacDonald and his partner, Hugh A. Smith, succeeded in interesting Boston capitalists and development was carried on through the winter and spring on the Gold Pan and Gold Seal claims. The vein on the Gold Pan from which the samples were taken is 32 in. wide on the 125-ft. level. McDonald is making arrangements to take a party of Winnipeg business men to inspect the area. The Rice Lake district, in which claims have been staked covering an area of about 7 mi. by 3 mi., lies between Lake Winnipeg and the Ontario boundary and about 100 mi. northeast of Winnipeg. The camp is 50 mi. from the nearest railway and there are numerous portages on the water route by way of Lake Winnipeg, Bad Throat Creek and Clearwater Lake.

The Mining News

ALASKA

ALASKA GASTINEAU (Juneau)—Milled in May 175,000 tons of $1.40 ore; tails, 24c.; extraction, 82.85%, as compared with 77.47% in March and 78.71% in April.

ARIZONA

Cochise County

SHATTUCK ARIZONA (Bisbee)—May production, 1,383,963 lb. copper; 25,865 oz. silver; 326 oz. gold.

EXPOSED REEF (Bisbee)—Owen T. Smith and J. P. Steele bonded this old gold property and will work it for tungsten.

Coconino County

WHITE MESA MINING (Flagstaff)—Robert Mitchell, of Nogales, and N. G. Douglas, of Phoenix, making detailed examination with view to purchase; low-grade porphyry deposit on Little Colorado River, north of Flagstaff.

Gila County

INSPIRATION (Miami)—Record broken recently when concentrator handled over 16,000 dry tons in 24 hr.; foundations for 19th and 20th units about completed.

CONTACT (Globe)—Situated in Pinal Mountains, 12 mi. south of Globe; acquired by New York men; contract calls for development to begin within 4 weeks.

Graham County

SAN JUAN COPPER (Safford)—Controlling interest bought by F. W. Estabrook, of Boston, a director of Miami Copper Co. Development on extensive scale will begin; churn drilling has already indicated 900,000 tons of 3.67% copper ore.

Mohave County

PAYROLL (Chloride)—Crosscut on 400-ft. level has struck main lead-zinc vein opened on the 200.

RESCUE (Chloride)—In the 45-ft. adit J. C. Clark has struck 4-ft. vein, carrying high silver and some gold.

TOWNE (Chloride)—Active development begun by Pasadena, Calif., men; S. S. Jones, formerly superintendent of Tom Reed mine, in charge.

W. B. RIDENOUR (Kingman)—Leasers extracting high-grade ore from this old mine in Grand Cañon; carload recently shipped brought $8,000.

Pinal County

ARIZONA ZINC AND LEAD (Ray)—Reported that mill will be erected; tunnel in 400 ft.; vein contains zinc, silver and gold.

CHRISTMAS (Christmas)—This A. S. & R. Co. mine shipping 250 tons daily to Hayden smeltery; aërial tramway from mine to Christmas. S. H. Sherman, superintendent.

PINAL DEVELOPMENT (Troy)—New company to develop Renfro group, about 860 acres, 1 mi. east of Troy; John C. Devine, president. Driving 1,200-ft. adit to reach deposit at depth of 500 ft.

U. S. VANADIUM DEVELOPMENT (Troy)—A $75,000 corporation, of Phoenix men, to develop Sullivan vanadium deposit, 1 mi. southeast of Troy. H. H. Temple, president; erection of mill being considered.

Yavapai County

GARDNER TUNGSTEN (Tip Top)—A 10-ton concentrator being hauled from Peoria, about 40 mi. southwest.

UNITED VERDE EXTENSION (Jerome)—Reported discovery of another high-grade orebody on 1,200-ft. level.

BLUE BELL (Mayor)—Copper orebody, running 4% to 5% copper, 26 ft. wide, explored for a distance of 80 ft. on 1,000-ft. level.

MAJOR M. & M. (Walker)—Operations will be resumed but will be confined to Eureka property until flotation mill is installed.

MARTIN, BUTLER & PRICE (Tip Top)—Sold tungsten property to Patch & Ingram, of Chicago, for $25,000; ore shipped from Turkey station.

ALTO (Prescott)—F. C. Norman and D. C. MacIver acquired this gold group in Thumb Buttes district, 8 mi. east of Prescott; 50-ton ball mill to be installed.

MONARCH (Wickenburg)—Controlling interest bought by T. R. Jones, of Carterville, Ga.; copper and gold ores; water for mill pumped 7 mi. from Hassayampa River.

CROWN KING TUNNEL (Crown King)—Actual driving of proposed 15,000-ft. tunnel under way; has opened copper ore. Dr. F. A. Wheeler, interested; see "Journal," Apr. 1, p. 660.

BRADSHAW REDUCTION (Crown King)—Holding company of Randolph-Gemmill Development Co. has taken over Tiger, Crown King and Wildflower mines; ores will be treated at Randolph-Gemmill reduction plant.

Yuma County

FORTUNA (Yuma)—W. H. Enderton claims to have found long lost lode of this famous old mine.

CACTUS QUEEN (Swansea)—Organization of Colorado and Missouri men to develop 119 copper claims purchased from J. C. Tappan for $100,000; H. H. Barsbee in charge.

PRIDE (Parker)—New hoist installed; shaft down 60 ft. in 10-ft. copper orebody.

ZEROLITE-MAMMON (Parker)—Shipments copper-gold ore going to smeltery at Garfield, Utah.

COBRITA MINES (Salome)—Shipped high-grade copper ore from this group of 14 claims, east of Tank Pass. D. W. Hall in charge.

BONANZA IMPROVEMENT (Salome)—Incline down 100 ft.; in gold-copper ore; shipments begun. R. R. McDonald, superintendent and principal owner.

EMPIRE (Parker)—Compressor and 12 drills being installed; will work Treasure Hill, a mountain 6 mi. north of Parker, for gold and silver.

SWANSEA (Swansea)—Deal for sale of mine and smeltery being held up by leases on the mine held by W. J. Thomas estate, which have about 9 months to run.

ARKANSAS

INTEREST IN OIL AND GAS DRILLING in Sebastian County is increasing. Within a 10-mi. radius around Fort Smith, 28 wells are being drilled.

MANGANESE MINING is active in Independence County, particularly around Pfeiffer, Batesville and Cushman. As much as 10 cars has been shipped in a single week.

CALIFORNIA

Amador County

CONSOLIDATED AMADOR (Sutter Creek)—Headframe installed and hoist tested. Collar sets placed in old shaft and being concreted. Pumps on ground; expect to begin pumping about June 15.

Butte County

ROBINSON (Drift)—Under bond to J. A. Veatch and associates of San Jose and Napa. Incline being sunk to intercept old channel on west branch of Butte Creek. Same men developing the Royal Drift on Big Butte ridge.

SPRINGER AND MATHEWSON (Quartz)—These properties under bond to Harry M. Thompson representing San Francisco capital. Ten men at work. Equipment consists of steam shovel, capacity 1,500 cu.yd. in 10 hr., large crusher and rolls to crush to 1-in. ring. Crushed ore is run through sluice boxes to save coarse gold and samples carefully taken. Present operations are merely for sampling. The vein is about 300 ft. wide and can be followed for miles through Butte County. Preliminary results so good that concentrating plant is now under construction.

Calaveras County

CROSSET (Angels Camp)—High-grade ore reported in this old prospect. Dan Mackey is developing.

AMERICAN GOLD DREDGING CO. (Comanche)—Third gold dredge on Mokelumne River to be installed.

CALAVERAS COPPER CO. (Copperopolis)—Improvements being made to flotation plant. Encouraging development in lowest levels.

Nevada County

NORTH STAR (Nevada City)—Telluride ore reported in the Providence on 1,800 level. Believed to be an extension of shoot the old Providence company worked on the 1,200.

San Bernardino County

EMPEROR (Nipton)—This group of G. H. Hamstadt, adjoining old Copper World property, leased to Arthur Kunze and Michael Conway. Three carloads of 24% copper ore and six cars of 40% zinc carbonate recently shipped.

PACIFIC MINES CORPORATION (Ludlow)—Has acquired property of Roosevelt Mining Co. and Bagdad Chase Gold Mining Co. About 300 acres, 9 mi. south of Ludlow. Opened to depth of 300 ft.; more copper at depth. Frank W. Royer estimates 100,000 tons of $10 ore above 300-ft. level; also 200,000 tons of $5 ore, for which mill may be built. Mayor James M. Curley, of Boston, is a director.

Sierra County

BLUE JAY (Downieville)—L. G. Higgins, owner, struck continuation of ledge which yielded rich pocket; taking out ore.

FINNEY MINES, INC. (Downieville)—Permitted to sell 31,250 shares, par $1, to net 80c. for purchase of machinery and equipment.

CLEVELAND GOLD MINING CO. (Sierra City)—Reorganization to clear title to Cleveland quartz mine being developed under bond, by R. G. Gillespie.

WILLOUGHBY (Gold Valley)—Ore showing free gold being mined. Milling to be resumed. E. M. Farrell and associates, of Downieville, owners.

ORO (Downieville)—Work resumed. New tunnel being run to cut lode 100 ft. deeper than lowest workings and tap rich shoot of No. 3. Dr. G. P. Reynolds, of Alameda, developing under bond. John Costa in charge.

Shasta County

GARFIELD (Redding)—J. W. Killinger has bonded this property in Old Diggings district and new tunnel will be driven 600 ft.

SHASTA NATIONAL COPPER CO. (Redding)—New corporation to develop mineral holdings in T. 34 N., R. 5 W., about

1,000 acres adjoining Mammoth property. William H. McEwen, C. F. Brouillard, N. P. Fries, S. S. Norton, of Redding, interested.

MAMMOTH (Kennett)—New sawmill installed at Stowell mine in operation; capacity 7,000 ft. per day. Cottages, boarding house, office and storehouses will be constructed; this camp employs 60 men, and the Spread Eagle, 2 mi. distant, 35 men. At the Friday-Lowden, new tunnel is in over 1,700 ft.; is 400 ft. lower than the No. 5 main working level of the Mammoth. Company has 1,200 men on payroll.

Tuolumne County

CHILANO (Tuttletown)—High-grade gold ore encountered after several months' development.

DUTCH-SWEENEY-APP (Jamestown)—Mill treating 200 tons daily. High-grade ore recently disclosed. M. J. Loring, manager, recently advanced wages 25c. per shift.

COLUMBIA (Tuolumne)—Unwatering of 200-ft. double-compartment shaft completed; shaft will be deepened to 1,000 ft. Old 10-stamp mill will be put in commission.

TARANTULA (Shawmut)—Operation resumed after long period of idleness. Ex-Gov. Henry T. Gage, of Los Angeles, recently took over property and has interested S. C. Thomson and associates of New York in this and adjoining properties.

RAWHIDE (Jamestown)—Water in shaft now at 800 level; sampling and assaying above proving satisfactory. Mine contains large body of low-grade ore. Lowest level 1,800 ft., and shaft may be deepened. Operated by Silver Peak Mining Co., John Mocine, manager.

COLORADO

Clear Creek County

BIG FIVE (Idaho Springs)—New tramway constructed to connect portal of tunnel with Colorado & Southern Ry. tracks.

LONE STAR (Idaho Springs)—This Chicago Creek property being unwatered; west drift from shaft will be advanced. W. R. McClellan, manager.

IMPERIAL (Lamartine)—Being developed under lease by Lindall & Eckberg through Money Musk shaft. Silver ore opened in drift.

MINERAL CHIEF (Georgetown)—Being cleaned out and retimbered preparatory to resumption. Moline tunnel will be advanced. Tramway will be overhauled. Charles Lancaster, superintendent.

RED OAK (Georgetown)—Development on Democrat Mountain resumed; Sceptre adit will be driven to connect with Sunburst adit which enters mountain from other side at slightly higher level. A short raise will connect and provide good ventilation. Raise will be extended from Sceptre adit to old Astor mine.

Denver County

AMERICAN COAL REFINING CO. (Denver)—Plant will be remodeled; cost of new machinery and ovens estimated $50,000. Principal products are flotation oils, ammoniacal liquor, tar, creosote and toluene.

Hinsdale County

NEVERSWEAT HILL was site of good discoveries recently. Teams hauling ore from Gladiator, General Sherman and Good Luck properties.

COLORADO-UTAH CO. (Lake City)—Operating old Golden Fleece mine; flotation process being installed.

Lake County

GARBUTT (Leadville)—Leasers producing 150 tons daily.

LA PLATA (Leadville)—Work started on this California Gulch property by W. E. Bowden Co.

Rio Grande County

EL MONTE MINING AND MILLING CO. (Monte Vista)—Building dry-concentration mill on Guadaloupe group across Alamosa River from Jasper. White auto-truck will haul supplies 33 mi. between Jasper and Monte Vista. E. V. Busch, superintendent.

San Miguel County

TOMBOY (Telluride)—In May, crushed 14,000 tons, yielding $47,400 in bullion and $65,000 in concentrates; expenses $63,-100; operating profit, $49,300.

COLORADO MANGANESE MINING AND SMELTING CO. (Norwood)—Development resumed on property below Norwood; ore hauled by wagon to Placerville and shipped thence to Ball Bros., of Muncie, Ind. James Belisle, manager.

Summit County

WASHINGTON (Breckenridge)—Mill will be remodeled; ore being blocked out.

UTAH TUNNEL (Kokomo)—Leased to Leadville men; large shoot zinc-sulphide ore opened.

HAMILTON (Breckenridge)—Repair of 750-ft. tunnel completed and driving resumed. New machinery, including a ball mill, will be installed in mill.

PUZZLE (Breckenridge)—New mill will treat ore from mine dumps, as well as production of Puzzle Leasing Co. This company pushing development work and shipping lead-carbonate ore.

IDAHO

Shoshone County

PAWTUXENT (Wallace)—Crosscut from Rex workings encountered ore that has been drifted on for 700 ft.; 14 men working. James F. Callahan, interested.

TAMARACK & CUSTER (Wallace)—Mine closed May 31. Reported Northport smeltery crowded with ore. New mill may be built across river from the Hercules.

HECLA (Burke)—Leased Federal 500-ton mill, formerly used by the Stewart; mill will not be operated at capacity. Contract for smelting reported renewed for one year with International Smelting Co.

FOUR TIMBERS (Wallace)—New compressor being installed on this property adjoining Ray-Jefferson. Lower tunnel being driven. William Shannon, manager. Colfax, Wash., men interested.

MICHIGAN

Copper

MASS CONSOLIDATED (Mass)—In May, mined 978 cars of ore averaging 13 lb. In addition, five cars of mass and barrel rock were sent direct to smeltery.

AHMEEK (Ahmeek)—May production was over 110,000 tons of ore; 101,000 tons in April. Seventh stamp head will go into commission about July 1; eighth head will be ready about middle of August, when mill will be able to handle about 5,600 tons of rock per day.

CALUMET & HECLA (Calumet)—The third of the new furnaces at Hubbell will be handling copper this month. Furnace will have capacity of from 150,000 to 200,000 lb., every other day; automatically operated. The 18 older smaller hand-fed furnaces are all working, three on poor stamp rock 15 on refinery work.

Iron

OHIO (Michigamme)—Regular shipments now being made. Only property working in Michigamme field, also the only place on the range where limonite ore is being mined. The Portland is expected to commence operating soon.

OLIVER (Ironwood)—Aurora's new shaft started; new Pabst shaft will be started in about two months. One will be vertical and the other inclined; they will replace three shafts now being used. All machinery will be operated by electricity. The company will spend about $1,000,000 in Ironwood this year.

MINNESOTA

Cuyuna Range

MAHNOMEN (Ironton)—This openpit property will make its maiden shipment in a few days, and by July 1 two shovels will be loading ore regularly.

HOCH (Manganese)—Management is reported to have contracted to deliver 60,000 tons of manganiferous iron ore, getting 40c. per unit for manganese content in excess of 18%.

FERRO (Manganese)—Record price for Cuyuna Range ores recently obtained by Onahman Iron Co., operating this mine. Shipment of 111.7 tons sold to Miami Products Co., Chicago, Ill., brought average price of $9.05 per ton. The average moisture was 7½%.

Vermilion Range

CHANDLER (Ely)—Foundations completed for new equipment at No. 5 shaft. Mining at new shaft will start soon.

MISSOURI-ARKANSAS

Joplin District

KANSAS-MISSOURI (Joplin)—Purchased Meadow Lark tract south of Duenweg and will develop. Drilling 11 years ago showed lead and silicate from 10 to 40 ft.

K. C.-JOPLIN (Joplin)—Installed new compressor, jigs, sludge tables and boiler at Red Lion mine. Ground drained and mining begun. Have 75-ft. face of 2.50% ore.

GIBSON & SCHERL (Joplin)—Paid $8,000 for 40-acre tract southwest of Duenweg, on which one shaft is going down; drilling recently showed good ore at about 200 ft.

U. S. SMELTING—Has abandoned mine at Reeds, Mo., and will move plant to lease near Cardin, Okla., recently bought for $125,000, adjoining the Blue Goose, one of district's biggest mines; prospecting has indicated equally rich orebody. It is a 6% lease from the Indians.

Northern Arkansas

WINCHESTER (Rock Creek)—Will erect mill.

PHILLIPS (Yellville)—Machinery for new mill has arrived.

SUMMIT HOME (Rush)—Crusher and jigs being installed.

SILVER RUN (Rush)—First concentrates shipped from new mill.

PARADISE (Dodd City)—Settles & Williams will erect mill immediately.

MORNING STAR (Rush)—Two men killed and two injured when slab fell June 3. Worst mining accident in history of Arkansas field.

MONTANA

Broadwater County

IRON MASK (Helena)—This lead mine on Indian Creek in Hassett district will be reopened by James Jobb. Opened to 350 ft. by shafts. Boiler and hoist on property.

Deer Lodge County

MONTANA RELIANCE GOLD MINES CO. (Southern Cross)—Sinking shaft to 300 ft., where crosscutting will be started. About 1,200 tons ore now on dump assaying $13.65 in gold per ton. New 600-cu.ft. compressor and headframe to be installed.

Silver Bow County

ANACONDA (Butte)—During May company's Washoe works broke its previous record in production of copper with total of 26,900,000 lb. At Great Falls copper production was about 4,000,000 lb. as against nearly double that amount in April. Total for both plants was about 31,000,000 lb. as against 33,600,000 lb. in April. At the Emma mine, new hoisting engine is in place and shaft sinking will begin soon. Development on 200, 400 and 600 levels has blocked out much zinc ore and it is expected 400 tons per day will be shipped to Washoe concentrator as soon as completed.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—Preliminary report for May gives net realization at $52,500 from 32,400 tons ore treated. Production was $214,500; operating expenses $162,000.

Humboldt County

ANTIMONY AND SILVER MINES CO. (Battle Mountain)—Properties in Galena Cañon include an antimony group now being worked with gasoline hoist. On the silver group, a whim is being installed. A. J. Weber, 305 Judge Bldg., Salt Lake City, Utah, president.

LA TOSKA (Hayden, via Oreana)—Main tunnel now in 2,800 ft. Now controlled by Humboldt Consolidated Mining Co.; Charles F. Champion, 108 So. La Salle St., Chicago, president. John B. Newman, superintendent.

Lincoln County

PRINCE CONSOLIDATED (Pioche)—Shipped in May 13,800 tons; below recent average; attention diverted to mill construction at Bullionville; milling to start in July.

Nye County

TONOPAH ORE PRODUCTION for week ended June 3 was 8778 tons valued at $183,264 compared with 9,400 tons for week previous. Producers were: Tonopah Belmont, 3,052 tons; Tonopah Mining, 2,100; Tonopah Extension, 1,850; Jim Butler, 750; West End, 566; Rescue-Eula, 151; Halifax, 198; North Star, 68; miscellaneous, 43 tons.

KANSAS CITY-NEVADA CONSOLIDATED MINES CO. (Bruner, via Luning)—Acquired Phonolite Paymaster, Phonolite Silent Friend, Big Henry and Duluth Gold Mining Co.; contemplate 50-ton mill, and 11-mi. pipe line to bring water from Ione Valley. R. E. Bruner, manager.

MIDWAY (Tonopah)—At No. 2 shaft, east and west drifts on 800-ft. level continue in full face of quartz with encouraging assays. On 1,100-ft. level south crosscut being driven. At No. 1 shaft 28 men working on leases with weekly shipments going to West End mill.

Storey County

CROWN POINT-BELCHER (Gold Hill)—On 300 level of Jacket, west crosscut cleaned out and repaired; 72 cars of ore saved. No work below 300 level, account gas from recent fire.

UNION CON. (Virginia)—Ore extraction for week: From 2,400 level, 191 tons, $26.01; 107 tons, $44.25; from 2,500 level, 90 tons, $20.22. On 2,700 level north drift extended 34-ft. point, face in quartz.

MEXICAN (Virginia)—On 2,500 level, north drift on west cross-cut advanced to 46-ft. point, face in porphyry and quartz of low assay. On 2,700 level, west crosscut advanced to 30-ft. point, face in porphyry and quartz. Mexican mill received 388 tons custom ore, average value $31.67.

SIERRA NEVADA (Virginia)—On 2,400 level, sampling old stope near south boundary and preparing to open old east crosscut. On 2,500 level, south drift advanced 3 ft. in low-grade ore. Winze in No. 1 stope sunk and timbered to 90-ft. point, bottom in quartz.

White Pine County

CONSOLIDATED COPPERMINES CO. (Kimberly)—John M Callow is reporting to directors on the advisability of remodeling old Giroux mill and installation of flotation process. Four churn drills have been operating since February with favorable results.

NEW JERSEY

NORTH AMERICAN COPPER CO. (56 Vanderbilt Ave., New York)—Purchased tract on Newark meadows and will erect plant for manufacture of copper products.

NEW MEXICO

Grant County

CARLISLE (Steeplerock)—Orebody, running high in gold, silver, copper and lead, discovered in unmapped old workings at bottom of 137-ft. winze from 500-ft. level; deposit developed by two crosscuts from 300-ft. tunnel. New concentrator running satisfactorily. Electric-light plant installed; camp has 300 inhabitants.

AUSTIN COPPER (Tyrone)—New organization to work high-grade continuation of mineral zone of Burro Mountain Copper Co. Capitalized at $1,500,000, shares $100 each; incorporators T. J. Findley, Charles Biesel, and J. W. Crowders, Robert Krakauer, W. E. Arnold, Wilber Judson, all of El Paso, and John M. Wiley, of Silver City, statutory agent. Leasers have been shipping from property.

Socorro County

SOCORRO MINING AND MILLING (Mogollon)—Treating over 200 tons daily, with production of about 2 tons of gold and silver bullion per month.

CLIFTON (Mogollon)—Oaks Co., of Alma, recently took bond on southerly half of this property from Socorro. Operations will be increased and ore shipped to Socorro mill.

PACIFIC (Mogollon)—Shaft at this property, recently optioned to Socorro, is being retimbered and other preparations made for extensive production. Aërial tramway to Socorro mill will be completed in 60 days, when from 50 to 75 tons of ore will be shipped daily.

TENNESSEE

THE OLD "SCHOOL PROPERTY," it was voted at last election, will be leased to William Young Westervelt, 17 Madison Square East, New York, and will be diamond drilled. Ducktown Copper, Sulphur and Iron Co. not interested, as reported. Property is south of Burra Burra mine of Tennessee Copper Co. and west of Mary mine of the Ducktown company.

UTAH

Juab County

TINTIC SHIPMENTS for week ended June 2 were 241 cars.

EUREKA MINES (Eureka)—To be opened at depth by drifts from the 1,500, 1,300, 900 and 600 levels of the Geminl.

NEW BULLION (Eureka)—This property in north Tintic is being worked under lease by J. C. Dick. Five cars lead-zinc ore shipped.

GEMINI (Eureka)—May shipments 2,200 tons. The Ridge & Valley, being developed through this property, shipped 4 cars, netting about $6,000.

Garfield County

GREEN & FAGERGREN (Coyote)—Have leased Utah Antimony Co.'s mine at Antimony. Began milling on May 21; heads 15% Sb; recovery about 95%. Ore opened by former operators about 150 ft. above bottom of cañon; ore face widening at depth. About 20 men working. Lessees experienced mill operators, formerly with Butte & Superior and Atwater mill in Montana; have offices at 218 Kearns Bldg., Salt Lake City.

Salt Lake County

SELLS (Alta)—Ore hauling begun. Over 200 tons accumulated. Ore opened in K.P. ground, recently acquired.

SOUTH HECLA (Alta)—About 75 tons being shipped daily from 250 and 350 levels. Development being done on the 500.

BOSTON DEVELOPMENT (Salt Lake)—During May, 350 tons were shipped, from 1,700-ft. level. Operating old Maxfield mine.

UTAH APEX (Bingham)—April profits estimated at $140,000, exceeding recently declared dividend of $132,000. March profits were $107,000.

UTAH COPPER (Garfield)—Directors appropriated $2,500,000 for enlargement of milling capacity. Present copper production about 170,000,000 lb. per annum.

SALT LAKE POWER AND WATER (Salt Lake)—Company formed to drive tunnel running southeasterly three miles from western slope of the Wasatch and ending at Maxfield mine. Here tunnel will be 2,000 ft. below surface, and will give 3,900 ft. on dip of the beds. Company will eventually take over Boston Development.

FORTUNA (Bingham)—Sold by Simon Bamberger to Leroy Eccles, of Ogden, and associates for $250,000; there are 150 acres of patented ground, and 12,000 ft. of workings; adjoins the Ohio Copper and the Dalton & Lark. Ore is heavy sulphide, carrying copper. There is also some lead-silver ore. Several veins on porphyry-quartzite contact and in quartzite itself.

Summit County

PARK CITY SHIPMENTS for week ended June 2 amounted to 4,921,395 lb.

KEYSTONE (Park City)—New compressor and electric machinery will soon be installed and shaft sinking begun.

JUDGE MINING AND SMELTING (Park City)—New steel headframe at Anchor shaft is in commission. Excavation for new zinc plant is in progress.

McFADDEN & ERICKSON (Park City)—Recently completed mill on Silver Creek began operating May 31. Six tables making lead-zinc concentrate.

NEW QUINCY (Park City)—Work carried on through the Daly West, showing favorably. Shipments for week ended June 2, made from the new strike, amounted to 128 tons.

VIRGINIA

Augusta County

KENNEDY (Lipscomb)—This manganese mine, formerly operated by Steel Ores Co. of Virginia, has been taken over by Manganese Products Co., 35 Wall St., New York.

CRIMORA (Crimora)—Readjusting mill; one-half in operation turning out carload of washed ore daily. Opencutting with 2-cu.yd. Cable Excavator Co. dragline bucket. William L. Hogg, manager.

Campbell County

PIEDMONT MANGANESE CORPORATION (Lynchburg)—Mine and mill purchased by Messrs. Van Ness, Herrmance and others. Preparation being made to bring daily mill capacity up to 200 tons of washed ore. Henry Mace Payne, consulting engineer, 233 Broadway, New York.

WISCONSIN

Zinc-Lead District

TIFFANY (Platteville)—Plans 150-ton mill at Potosi.

BELL (Platteville)—The 100-ton mill will be completed by July.

M. & A. (Platteville)—New mill will be in operation about July 1 at Rewey.

VANDEVENTER (Benton)—Roy Coulthard and others have organized Greater Mining Co. to reopen this old producer.

WEST END (Platteville)—Incorporated by D. J. Gardner and partners to develop prospect on Louis Weigle farm, 4½ mi. southwest of Platteville; small milling plant will be built.

WICKS (Mineral Point)—This new company has let contract to C. C. Mathey to move Liverpool mill at Mineral Point to its prospect at Linden. C. J. Fawkes, Mineral Point, president.

CANADA

Ontario

AGUANICO (Cobalt)—Under option to the Coniagas; now idle.

KERR LAKE (Cobalt)—Optioned Maidens claim in South Lorraine.

CANADIAN COPPER CO. (Copper Cliff)—Will spend $250,000 on new dwelling houses at Copper Cliff and at the Creighton mine; also about $300,000 in additions to hydro-electric plant.

McINTYRE (Porcupine)—Directors of McIntyre, McIntyre Extension and Jupiter companies considering amalgamation. The McIntyre holds stock control of the two others, but with recent promising developments a complete amalgamation considered advisable.

DOME (Porcupine)—Costs for May: Mining and hoisting, 79c.; development, 60c.; crushing and conveying, 8c.; milling, 72c.; general expense, 27c., making a total of $2.46 a ton; understood to cover all charges including depreciation. Tonnage milled was 39,400 tons. Three new 8-ft. Hardinge ball mills ordered to replace stamps.

COLUMBIA

CERTIGUE DREDGING CO.—William H. Houston, of Red Bank, New Jersey, U. S. A., was appointed receiver on May 22 for this company having placer property on Certigue River in Department of Choco.

ANGLO-COLOMBIAN DEVELOPMENT CO. (Andagoya, via Buenaventura)—This company estopped on May 29 from operating its dredge on Condoto River; injunction obtained by Henry G. Granger, who claims gold-platinum ground in which dredge was operating.

The Market Report

Metal Markets

NEW YORK—June 14

The reactionary tendency in all the metals continued, with, however, a far better undertone in copper than in anything else. The outstanding feature of the week was the extraordinary dullness, the transactions in both copper and spelter being unusually light.

Copper, Tin, Lead and Zinc

Copper—The principal producers reported no business and scarcely any inquiry. One firm bid for a round lot for export had to be refused, owing to time conditions, not by reason of inability to supply the copper, but owing to impossibility of getting the freight room at just the time necessary.

Incidentally, it may be remarked that foreign buyers are now more independent, and intimate that they will cancel contracts if the stipulated time for shipment is not conformed to exactly. This imposes another element of chance upon the exporter, and without doubt reflects the increasing ease of the metal situation abroad. Also it may be remarked that ocean freight rates are becoming easier, although still very high. The present cost of putting copper in Europe is estimated at about 1c. per lb., whereof ¾c. is for freight.

Returning to the subject of the domestic market, copper for July and August delivery was easily to be had. In the absence of transactions quotations are necessarily based on offers to sell and therefore are more or less nominal. The market appeared to be on the basis of about 27c., net cash, New York. Futures were offered at 26c., or slightly higher.

Copper Exports from Atlantic ports June 1-10 were heavy, reaching a total of 12,807 tons. Exports from Baltimore for the past week included 1,400,332 lb. copper to Great Britain; 2,521,799 lb. to France.

Copper Sheets are unchanged at 37.5c. for hot rolled and 38.5c. for cold rolled. Copper wire is 32½@33c. per lb. for large lots at mill.

Visible Stocks of Copper in Europe June 1 were: Great Britain, 2,792; France, 3,770; afloat from Chile, 3,000; afloat from Australia, 4,100; total, 13,662 gross tons, or 30,602,880 lb. This is a decrease of 46 tons from the May 15 report.

Tin—There was a fair business, mostly in futures. The market fluctuated more or less in conformity with the market in London.

Visible Stocks of Tin May 31, including tin afloat: London, 7,834; Banka and Billiton, 4,505; United States, excluding Pacific ports, 7,275; total, 19,614 gross tons; a decrease of 125 tons from Apr. 30, but an increase of 4,968 tons over May 31 last year.

Lead—Business in this metal was less than in the previous week, although several lots of pretty good size were reported sold. There was again considerable perplexity respecting prices, the principal producer maintaining its prices unchanged, and doing some business, while all of the outside producers were cutting prices. On June 14 a round lot was sold at 6.70c., New York, and another of almost the same size was done at 6.55c., St. Louis. The trade is looking for a further cut by the A. S. & R. Co., to be made soon.

Spelter—The business in spelter was extraordinarily light, and in the absence of reported transactions of significance our quotations are nominal, based on offerings, representing the average of the market as nearly as we can determine. The certain thing is that the market became distinctly weaker during the week on offerings by small producers, reselling consumers and traders. The large producers in general stood aloof, realizing their inability to dispose of tonnages at anything but such concessions as they did not like to contemplate. The market was, therefore, free from general pressure, although there were signs of pressure from certain quarters.

At the close, June spelter was offered at 12½c., July at 12c., third-quarter at 11½c., fourth-quarter at 10½c., and last half of the year at 11c. At those prices there were sellers but not buyers, save for occasional nibblers. Producers were apparently desirous of selling all they could for the last half of the year at 11c., or as near that as they could get.

Under the provisions of the Trading With the Enemy Amendment Act, 1916, the British Board of Trade has made an order determining all contracts between the Zinc Corporation and Aron Hirsch & Sohn.

The Sulphide Corporation intends to exercise its option to purchase the property of the Central Zinc Co., and will increase the capacity of the smeltery at Seaton Carew, which when enlarged will have capacity for smelting 30,000 tons of ore per annum.

Zinc Sheets are easier. The base price was reduced on June 13 to $20 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Antimony—There has been no change in the stagnant condition of the market. Prices have been continually shaded without bringing out any business except on Monday, when

DAILY PRICES OF METALS IN NEW YORK

June	Sterling Exchange	Silver, Cts. per Oz.	Copper Electrolytic, Cts. per Lb.	Tin Spot, Cts. per Lb.	Lead New York, Cts. per Lb.	Lead St. Louis, Cts. per Lb.	Zinc St. Louis, Cts. per Lb.
			27		6.90	6.75	11.75
8	4.7569	66½	@27½	44½	@7.00	@6.90	@12.50
			26½		6.90	6.75	11.25
9	4.7569	62½	@27½	45	@7.00	@6.90	@12.25
			26½		6.90	6.75	11.50
10	4.7569	63½	@27½	44½	@7.00	@6.90	@12.25
			26½		6.80	6.70	11.25
12	4.7569	64½	@27½	44	@7.00	@6.90	@12.00
			26½		6.75	6.70	11.25
13	4.7569	63½	@27½	43	@7.00	@6.80	@12.00
			26½		6.70	6.55	11.25
14	4.7569	63	@27½	43½	@7.00	@6.65	@12.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

June	Silver	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic £ per Ton	Copper Electrolytic Cts. per Lb.	Tin Spot	Tin 3 Mos.	Lead £ per Ton	Lead Cts. per Lb.	Zinc £ per Ton	Zinc Cts. per Lb.
8	31⅛	123½	119	142	30.23	187½	187¼	32¼	6.89	76	16.18
9	30	123½	119½	142	30.23	187¼	188	31¼	6.76	71	15.12
10	30¼	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12	31	121½	119	142	30.23	184¼	185	31¼	6.76	70	14.90
13	30½	121	118½	141	30.02	181½	182½	31½	6.65	68	14.48
14	30¼	118	116	140	29.81	183¼	183¼	31½	6.70	68	14.48

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

there were some transactions which, however, had no effect on the market. The rumored foreign government orders, amounting to between 400 and 500 tons, have not been placed and no bids were made, the representatives being content to wait for further recessions in price. Spot is quoted at 21c. per lb. Shipment from China within one month is quoted nominally at 18@19c. per lb., c.i.f. New York, duty unpaid.

Aluminum—Contract deliveries are a little slower, and outside supplies are limited. Prices have hardened a little, and quotations are now 59@61c. per lb. for No. 1 ingots, New York.

Nickel—The market continues steady with about the same amount of domestic business as usual and with some demand for export. Quotations are 45@50c. per lb. for ordinary forms, according to size and terms of order. Electrolytic nickel brings 5c. per lb. premium.

Quicksilver continues weak and business rather slow. The New York quotation is $68 per flask of 75 lb. for large lots; $68@70 for smaller orders. There are reports that these prices have been shaded down as low as $65. San Francisco reports by telegraph $70 per flask on a quiet market. London price is unchanged at £16 10s. per flask, which is considerably above New York. There are reports of some imports at New York from Mexico and South America, but they have been small lots only.

Gold, Silver and Platinum

NEW YORK—June 14

Gold imports from Canada continue, the total amount received on this movement being now nearly $49,000,000 It is understood that the gold reserve held at Ottawa is largely gold from the Transvaal, which reaches Canada through Pacific ports.

Transvaal gold production in May is reported by cable at 777,681 oz., which is 23,009 oz. more than in April, and 14,133 oz. more than in May, 1915. For the five months ended May 31 the total was 3,652,768 oz. in 1915, and 3,870,103 oz.—or $79,995,029—in 1916; an increase of 217,335 oz. this year.

Platinum continues quiet with small transactions only, and no considerable change in conditions. Prices are a little easier, $77@79 per oz. being quoted for refined platinum. Hard metal is $4@6 higher, according to quality.

The Board of General Appraisers has decided that wire made of a platinum-rhodium alloy is not free as platinum, but is subject to duty as an unenumerated wire product.

Silver—The market continues to decline, owing to less competition among buyers, and to sales made on China account, in some way connected with the poor export situation and low exchanges.

Mexican dollars have been quoted in New York, June 8, at 48¼@53¼c.; June 10, at 49@54c.; June 12 at 49⅞@55c.; June 13 and 14 at 49⅛@54c. The range is rather unusual.

EXPORTS AND IMPORTS

Exports of Copper from the United States for April and the four months ended Apr. 30 are reported by the Department of Commerce as follows, in pounds:

	April	Four Months
Ore and concentrates, contents	366,741	1,254,960
Blister and black copper	.....	3,015,015
Refined, ingots, bars, etc	43,391,756	207,261,733
Plates and sheets	686,656	6,180,287
Wire	2,430,371	7,777,975
Old and scrap	11,986	28,062
Total, lb	46,887,510	225,518,032
Manufactures of copper, value	$1,043,801	$4,724,452

The actual tonnage of ore and concentrates exported in April was 33,217 tons ore, 10,218 tons concentrates and 1,394 tons matte.

Imports of Copper for April and the four months ended Apr. 30 are reported by the Department of Commerce as below, in pounds:

Imports:	April	Four Months
Ore and concentrates, contents	11,508,841	48,702,395
Matte, contents	1,374,602	8,383,147
Unrefined, blister, etc	27,065,679	94,579,304
Refined, bars, plates, etc	1,918,332	2,498,490
Composition, copper chief value	81,582	233,134
Old and scrap	861,058	3,591,813
Total, lb	42,810,094	157,988,283
Copper manufactures, value	$4,105	$15,808

Actual tonnage of copper-bearing material imported in April was 33,217 tons ore, 19,218 tons concentrates and 1,394 tons matte. The net exports of copper in all forms were 67,529,749 lb. for the four months. Of the imports 96% were in ore, matte and blister copper.

Imports of Lead in all forms in April and the four months ended Apr. 30 are reported as below by the Department of Commerce, in pounds:

	April	Four Months
Lead in ore	3,243,475	9,133,451
Lead in base bullion	142,374	13,792,289
Lead, metallic	2,267,735	2,543,659

The actual quantity of ore was 18,213 tons, of which 10,076 tons were from Mexico. The base bullion was nearly all from Mexico.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—June 10

The base price paid this week for zinc ore was $77@78 per ton for top grades, down to $70 base for medium grades. The base price paid for 80% lead ore was $84 per ton.

SHIPMENTS WEEK ENDED JUNE 10

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	5,258,000	235,700	573,600
Year	103,684,000	3,811,930	26,769,700

Shipped during week to separating plants, 5,598,000 lb. zinc ore.

JOPLIN, MO.—June 10

Blende, high price, $92.10; per ton 60% zinc, premium ore, $90; medium, $85@75; lower grades, $70; calamine per ton 40% zinc, $65@55; average selling price, all grades of zinc, $78.66 per ton. Lead, high price, $85; base, $92.50@82.50 per ton 80% metal content; average selling price, all grades of lead, $82.34 per ton.

SHIPMENTS WEEK ENDED JUNE 10

	Blende	Calamine	Lead	Values
Totals this week..	12,547,220	510,430	2,693,700	$624,527
Totals this year...	320,830,720	26,545,560	54,994,260	$19,545,960

Blende value, the week, $499,510; 23 weeks, $17,071,230.

Calamine value, the week, $14,180; 23 weeks, $972,370.

Lead value, the week, $110,880; 23 weeks, $2,501,760.

It is estimated the mixup arising from the strike of hoistermen restricted the output of the Webb City and Duenweg mines one-third, failing to have any effect in other parts of the district. All mines desiring have put on nonunion men and are running undisturbed. A number are taking advantage of low ore prices to overhaul old and add new equipment.

OTHER ORES

Manganese Ore continues strong, but it is difficult to give quotations, as most deliveries of imported and domestic ores are on contract. The nearest available prices are 75@85c. per unit for Brazilian and Indian ores.

Tungsten Ore is very quiet. Holders are not now pressing sales and only small business has been done, at about $32@36 per unit for ore running 55 to 65% WO_3. There has been no resumption of general buying.

Antimony Ore has been sold during the week at $2.50 per unit for immediate delivery, but the demand is falling off.

Iron Trade Review

NEW YORK—June 14

The iron and steel trade show but little change from the last report. It is an accepted fact that domestic orders are being held back, the high prices and the probable delay in deliveries being the determining factors. Thus many building projects are held in suspense or are waiting until conditions are better.

Pig iron outside of the steel works continues slow and sales are on a moderate scale. Southern iron is being pushed for sale to some extent. Much of this is due to holders of speculative iron who are beginning to be desirous, perhaps anxious, to realize on their holdings.

Exports from Baltimore for the week included 1,101 tons pig iron; 2,498 tons old rails and 1,970 tons barbed wire to Italy; 13,124 tons steel rails and 622 tons rail joints to France; 2,491,421 lb. bars, 946,600 lb. wire rods and 112,000 lb. wire to Great Britain.

The United States Steel Corporation reports the total unfilled orders on book, May 31, at 9,937,798 tons of material; an increase of 108,247 tons over Apr. 30, making a new record.

Pig-Iron Production—The reports of the blast furnaces, as collected and published by the "Iron Age," show that on June 1 there were 321 coke and anthracite furnaces in blast having an aggregate daily capacity of 108,400 tons; a decrease of 700 tons from May 1. Making allowance for the charcoal furnaces the total make of pig iron in May was 3,386,000 gross tons; for the five months ended May 31 it was 16,364,800 tons. Of this total 11,533,900 tons, or 70.5%, were made by the furnaces owned or operated by steel companies. The May production was at the rate of over 40,000,000 tons a year.

PITTSBURGH—June 13

While the steel market has continued to grow quieter in general, there is still a great deal of activity in some directions, particularly in the export line. Although fully 500,000 tons of shell steel was placed with mills in May there have been moderately heavy bookings since the first of this month and there is still fairly large inquiry. The Steel Corporation is understood upon good authority to have received orders for no less than 175,000 tons of barb wire from Russia, while a relatively small tonnage was placed with independents. There is a moderate volume of buying in the domestic market for early deliveries of various steel products, while there is some contracting for bars, plates and shapes for late deliveries, most of the contracts requiring specifications to be filed during the fourth quarter, although delivery is not promised before the next quarter.

On account of heavy production, and by reason of a slight slowing down in the rate of specifying against current contracts, the large mills are able occasionally to offer some relatively early deliveries, and the premiums hitherto paid to smaller mills for prompt shipments are dwindling. Prompt plates, however, still command 3.75c.

Even with as dull a market as anyone expects the steel market should remain very strong for several months, while with a moderate amount of buying during the next few months the position should be secure throughout the year.

Most members of the trade were surprised by the Steel Corporation showing a gain in unfilled obligations during May of 108,247 tons, as the state of the market in the month would have suggested a loss. It appears that the gain was caused by heavy export orders, chiefly of war material, reinforced by some rail business that was virtually closed before the $5 advance of May 1, but was formally entered during May. A decrease in June is generally expected.

More miners are returning to work in the Pittsburgh coal district, pending a settlement of the difficulties growing out of the recent scale settlement, and fully one-third the union mines in the district are operating. The steel mills have paid as high as $2 to $2.75, delivered, for coal, but are not buying this week.

Pig Iron—The local market is extremely quiet in all directions, except that there is continued good demand for bessemer for export, and in some quarters this is expected eventually to cause the market to advance on bessemer and other grades. Domestic demand is very light but furnaces are maintaining prices. We quote: Bessemer, $21; basic and malleable, $18.25 @18.50; foundry, $18.50; forge, $18, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh. Pig iron is being produced at the rate of 40,000,000 tons a year and the rate is likely to decrease, rather than increase, owing to hot weather.

Steel—The market is fairly strong. Mills are offering odd lots of soft steel, as they find open capacity, at $40@42, for either billets or sheet bars and would probably name similar prices on a round tonnage for extended delivery. The mills have been selling all the discard billets arising in the manufacture of shell steel that the market would absorb, as such steel can be used only by certain consumers, and there are now large accumulations, perhaps exceeding 200,000 tons. This will have to be reserved for future consumption as the industries can absorb it, or be used by the mills as scrap.

FERROALLOYS

Spiegeleisen is in better supply and is quoted $60@65 per ton at furnace for 20%, and about $70@75 for prompt delivery.

Ferrosilicon is unchanged at $83@85 at furnace for 50%. Bessemer ferrosilicon is from $33 per ton for 10% up to $43 for 16%, at furnace.

Ferromanganese—Demand for prompt ferromanganese continues very light. Occasional sales of prompt and July are made at $250. The contract price remains at $175, with 1917 deliveries offered.

The production of ferromanganese and spiegeleisen in the United States in May was 35,844 tons; for the five months ended May 31 it was 69,411 tons in 1915, and 145,837 tons in 1916; an increase of 76,426 tons this year.

Imports of ferromanganese into the United States in April were 6,497 gross tons; for the four months ended Apr. 30 they were 25,898 tons.

SAULT STE. MARIE CANAL TRAFFIC

The freight passing through the Sault Ste. Marie Canals in May was 12,293,476 net tons, an increase of 4,944,909 tons over May, 1915. For the season to June 1 the total tonnage was: East bound, 11,319,403 net tons; west bound, 3,189,435; total, 14,508,838 tons, an increase of 5,725,536 tons over last year. The total number of vessel passages this year was 3,913, showing an average cargo of 3,701 tons. The mineral freights included in the totals were in net tons except salt, which is given in barrels:

	1915	1916	Changes
Anthracite	378,221	352,108	D. 26,113
Bituminous coal	1,397,902	2,581,150	I. 1,183,248
Iron ore	5,318,633	9,019,862	I. 3,701,229
Pig and manufactured iron	46,901	44,509	D. 2,392
Copper	28,118	13,423	D. 14,695
Salt, bbl.	147,301	179,882	I. 32,581

Of the total number of vessels 2,969 passed through the United States canal and 944 through the Canadian canal

IRON ORE

Lake iron ore continues strong, though there is little present activity in the market, most contracts being closed for the season. Shipments are moving quickly, many furnaces taking ore direct from the boats, so that unloading to docks is quite light.

Shipments of ore by ports for the season to June 1 are reported by the Cleveland "Iron Trade Review" as below, in gross tons:

Port.	1915	1916	Changes
Escanaba	528,566	1,443,400	I. 914,834
Marquette	183,365	614,813	I. 431,448
Ashland	557,665	1,102,893	I. 545,228
Superior	851,064	1,933,681	I. 1,082,617
Duluth	2,149,310	3,209,325	I 1,060,015
Two Harbors	1,246,222	1,803,879	I. 557,657
Total	5,516,192	10,107,991	I. 4,591,799

The total increase this year was 83.2%. The May shipments were the largest ever reported in a single month.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 431,872 net tons; shipments, 431,235 tons. Shipments of Greensburg and Upper Connellsville districts, 40,820 tons.

Connellsville—Prompt furnace coke commanded $2.75 all last week but this week the market is easier, with sales at $2.40 and ample supplies available at $2.50. Pressure for prompt coal has abated on account of more miners returning to work in the Pittsburgh district. Two second-half contracts have lately been closed, one for about 20,000 tons a month of particularly good grade, at $2.65, and another for a smaller tonnage at about the same price. Operators are not asking above $2.75 and negotiations now pending are likely to result in contracts at less. We quote: Spot furnace, $2.40@2.50; contract, $2.50@2.75; spot foundry, $3@3.50; contract, $3.50, per net ton at ovens.

Anthracite Shipments in May are reported at 5,547,899 gross tons, being 1,019,115 tons more than in April, but 250,062 tons less than in May, 1915. For the five months ended May 30 the total shipments were 26,378,266 tons in 1915, and 27,784,690 tons in 1916; an increase of 1,306,484 tons, or 5%, this year.

Chemicals

NEW YORK—June 14

The general markets are again quieter, although current demand is strong and deliveries on contract are heavy. New business, however, has been rather light.

Arsenic—Demand is rather slow, but there is no pressure to sell, and hardly any change in prices. Current quotations are $6.25@6.50 for spot, according to size of order; $6 per 100 lb. for futures.

Copper Sulphate—Exports have been lighter and the market is easier, sales being made at $14@15 per 100 lb. for carload lots for prompt delivery.

Nitrate of Soda—Business has been fair for the season, and prices are steady at $3.10 per 100 lb. for spot. Futures are stronger, $3.10@3.20 per 100 lb. being asked for forward positions.

Pyrites—Arrivals at Baltimore for the week included 3,583 tons iron pyrites from Seville, Spain.

Sulphur—The market is firm, with an active demand, and prices are strong, $35 per ton being asked for spot and $30 per ton for futures.

PETROLEUM

Exports of mineral oils from the United States in April were 156,170,113 gal., being 13,415,523 gal. less than in April, 1915. For the four months ended Apr. 30 the total exports were 634,775,054 gal. in 1915, and 725,424,918 gal. in 1916; an increase of 90,649,864 gal., or 14.3% this year.

According to a recent report the production of the Baku oil fields in Russia was 573,000,000 poods—or 69,000,000 bbl. of 42 gal.—in 1915; an increase of 2,000,000 bbl. over the previous year.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Mont.	June 15	July 15	$0.005
Algomah, Mich.	May 18	.....	1.00
Alpha, Nev.	June 7	June 28	0.03
Arbroath, Wash.	June 1	July 1	0.002
Best & Belcher, Nev.	June 9	June 28	0.05
Blue Bell, Ida.	July 8	Aug. 5	0.002
Bullion, Ida.	July 10	July 31	0.01
Cedar Creek, Ida.	July 5	Aug. 5	0.01
Central Eureka, Calif.	June 16	July 14	0.05
Challenge, Nev.	June 12	July 7	0.05
Coeur d'Alene Antimony, Ida.	June 3	.....	0.01
Confidence, Nev.	June 23	July 14	0.10
East Hercules Ext., Ida.	May 1	July 3	0.0015
Emerald, Utah.	June 15	July 8	0.0033
Enterprise, Ida.	May 20	June 20	0.001
Fortuna, Utah.	June 15	July 8	0.005
Friend, Ida.	June 30	July 20	0.002
Giant, Ida.	June 16	July 17	0.003
Goldstrike Bon., Utah.	June 15	July 15	0.01
Idaho & Los Angeles, Ida.	June 2	July 1	0.005
Imperial, Ida.	June 12	July 12	0.005
Independence, Ida.	July 8	July 29	0.001
Laclede, Ida.	July 3	July 25	0.003
Leonora, Utah.	June 20	July 11	0.005
Liberty, Utah.	June 15	July 3	0.005
National, Ida.	June 2	July 3	0.02
North Franklin, Ida.	June 19	July 8	0.005
North Lake, Mich.	June 14	.....	1.00
Old Veteran, Ida.	July 8	Aug. 5	0.002
Ophir, Nev.	June 13	July 6	0.05
Phedora, Ida.	May 9	July 1	0.005
Rio Grande, Nev.	June 22	July 22	0.002
Rob Roy, Ida.	June 10	July 10	0.002
Rockford, Ida.	June 30	July 21	0.002
Roosevelt, Utah.	June 1	July 1	0.02
Silver Pick, Nev.	July 5	Aug. 14	0.01
Silver Star, Ida.	June 14	July 1	0.002
Sonora, Ida.	June 5	June 30	0.004
Sunset, Ida.	June 3	June 24	0.002
Swansea, Utah.	July 10	Aug. 1	0.0025
Tarbox, Ida.	May 6	June 20	0.05
Uvada, Nev.	June 24	July 27	0.02
Wallace, Ida.	June 29	July 29	0.0025

Stock Quotations

SAN FRANCISCO June 13	Bid.
Name of Comp.	
Alta.	.06
Andes.	.11
Best & Belcher.	.06
Bullion.	.02
Caledonia.	.40
Challenge Con.	.02
Confidence.	.10
Cons. Imperial.	.01
Con. Virginia.	.17
Gould & Curry.	.01
Hale & Norcross.	.05
Jacket-Cr. Pt.	.07
Mexican.	.18
Occidental.	.70
Ophir.	.33
Overman.	.05
Savage.	.05
Seg Belcher.	.02
Sierra Nevada.	.30
Union Con.	.91
Utah Con.	.01
Belmont.	4.00
Jim Butler.	.97
MacNamara.	.07
Midway.	.25
Mont.-Tonopah.	.25
North Star.	.18
Rescue Eula.	.48
West End Con.	1.00
Atlanta.	.11
Blue Bell.	.01
Booth.	.16
C.O.D. Con.	.03
Comb. Frac.	.08
D'field B.B.	.03
D'field Daisy.	‡.03
Jumbo Extension.	.86
Pitts.-Silver Peak.	.09
Round Mountain.	.72
Sandstorm Kendall.	.04
Silver Pick.	.09
Central Eureka.	.05
Argo.	.18
Big Jim.	1.00
Lazy Boy.	.17
Oatman Cres.	‡.42
Oatman No. Star.	.20
Tom Reed.	1.50
United Eastern.	4.00
United Western.	.12

LONDON	May 31
Alaska Tre'dwell	£6 10s 0d
Burma Corp.	2 12 6
Cam & Motor.	0 14 0
Camp Bird.	0 9 9
El Oro.	0 10 0
Esperanza.	0 11 3
Mexico Mines.	4 2 6
Nechi, pfd.	0 14 0
Oroville.	0 16 0
Santa Gert'dis.	0 14 9
Tomboy.	1 3 9

SALT LAKE June 13	Bid.
Name of Comp.	
Beck Tunnel.	‡.22½
Black Jack.	.09
Colorado Mining.	.18
Crown Point.	.05½
Daly-Judge.	7.90
Emma Cop.	.64
Gold Chain.	.27
Grand Central.	.58
Iron Blossom.	1.85
Lower Mammoth.	.04½
May Day.	.14
Opohongo.	.01½
Prince Con.	1.27½
Seven Troughs.	.02½
Silver King Coal'n.	2.80
Silver King Con.	3.15
Sioux Con.	.15
Uncle Sam.	‡.06½
Yankee.	.30

COLO. SPRINGS June 13	
Acacia.	.03½
Cripple Cr'k Con.	‡.00½
Doctor Jack Pot.	.10½
Elkton Con.	.17
El Paso.	.79
Findlay.	.03½
Gold Sovereign.	.03½
Golden Cycle.	2.08
Granite.	.69
Isabella.	.18
Jack Pot.	.05
Jerry Johnson.	.04½
Mary McKinney.	.30
Portland.	1.70
Vindicator.	1.40

TORONTO June 13	
Bailey.	.08
Chambers Ferland.	.22
Coniagas.	5.00
La Rose.	.62½
Peterson Lake.	.26
Right of Way.	.05
Seneca Superior.	.28
T. & Hudson Bay.	‡33.00
Temiskaming.	.66
Trethewey.	.22
Wettlaufer-Lor.	.07
Dome Exten.	.34
Dome Lake.	.35
Foley O'Brien.	.50
Hollinger.	30.00
Imperial.	.03
Jupiter.	.39
McIntyre.	1.68½
Porcu. Crown.	.87½
Preston E. D.	‡.03
Vipond.	.55
West Dome.	.39

N. Y. EXCH. June 13	Clg.
Name of Comp.	
Alaska Gold M.	22
Alaska Juneau.	9
Am.Sm.&Ref.,com.	96⅛
Am. Sm. & Ref., pf.	113
Am. Sm. Sec., pf. A	95⅛
Am. Sm. Sec., pf. B.	86½
Am. Zinc.	85½
Anaconda.	85½
Batopilas Min.	2
Bethlehem Steel.	444
Bethlehem Steel, pf.	470
Butte & Superior.	95
Chile Cop.	21⅛
Chino.	54⅛
Colo. Fuel & Iron.	44½
Crucible Steel.	85⅛
Dome Mines.	27½
Federal M. & S.	18
Federal M. & S., pf.	38
Great Nor., ore ctf.	38½
Greene Cananea.	46⅛
Homestake.	130½
Inspiration Con.	48
International Nickel	46½
Kennecott.	52½
Lackawanna Steel.	71½
Miami Copper.	35½
Nat'l Lead, com.	68
National Lead, pf.	113
Nev. Consol.	18⅛
Ontario Min.	7½
Quicksilver.	2½
Quicksilver, pf.	3½
Ray Con.	23⅛
Republic I&S, com.	48½
Republic I&S, pf.	111⅛
Sloss-Sheffield.	53
Sloss-Sheffield, pf.	96⅛
Tennessee Copper.	43
Utah Copper.	83½
U. S. Steel, com.	86½
U. S. Steel, pf.	117⅛
Va. Iron C. & C.	50

N. Y. CURB June 13	
Name of Comp.	
Adanac.	.62
Alta Con.	.54
Beaver Con.	.40
Buffalo Mines.	1½
Butte & N. Y.	2½
Butte C. & Z.	7
Can. Cop. Corpn.	1 11/16
Cashboy.	.08
Cerro de Pasco.	37
Con. Ariz. Sm.	1 9/16
Con. Coppermines.	2½
Con. Nev.-Utah.	⅛
First Nat. Cop.	4½
Florence.	.44
Goldfield Con.	.92
Goldfield Merger.	.09½
Granite.	.35
Hecla Min.	5½
Howe Sound.	4½
Jerome Verde.	2 5/16
Joplin Ore & Spel.	5½
Kenefick Zinc.	‡13½
Kerr Lake.	4⅛
Magma.	15½
Majestic.	1/16
McKinley-Dar-Sa.	.55
Mines of Am.	2⅛
Mother Lode.	.32
Nevada Hills.	.21
N. Y. & Hond.	15½
Nipissing Mines.	7
Oro.	.05
Ray Hercules.	3⅛
Rochester Mines.	.69
St. Joseph Lead.	15⅛
Standard S. L.	1⅛
Stewart.	5/16
Success.	.82
Tonopah.	6½
Tonopah Ex.	5½
Tribullion.	⅜
White Knob, pf.	1½
Yukon Gold.	2

BOSTON EXCH June 13	Bid
Name of Comp.	
Adventure.	2⅛
Ahmeek.	400
Algomah.	‡1½
Allouez.	68
Ariz. Com., ctfs.	8⅛
Bonanza.	‡.25
Butte-Ballaklava.	2½
Calumet & Ariz.	71⅛
Calumet & Hecla.	550
Centennial.	16½
Copper Range.	62½
Daly West.	2½
East Butte.	12½
Franklin.	7½
Granby.	86½
Hancock.	13
Hedley.	‡20
Helvetia.	.25
Indiana.	3
Island Cr'k, com.	49
Island Cr'k, pfd.	91
Isle Royale.	28½
Keweenaw.	3⅛
Lake.	15
La Salle.	3½
Mason Valley.	2⅛
Mass.	11⅛
Mayflower.	2½
Michigan.	3½
Mohawk.	97½
New Arcadian.	6½
New Idria.	13
North Butte.	21⅛
North Lake.	.86
Ojibway.	1½
Old Colony.	1⅛
Old Dominion.	72
Osceola.	93
Quincy.	91
St. Mary's M. L.	77
Santa Fe.	2½
Shannon.	8⅛
Shattuck-Ariz.	31⅛
So. Lake.	7
So. Utah.	.25
Superior.	16
Superior & Bost.	4
Tamarack.	48
Trinity.	5⅛
Tuolumne.	.48
U. S. Smelting.	78
U. S. Smelt'g, pf.	51½
Utah Apex.	4⅛
Utah Con.	13⅛
Utah Metal.	8½
Victoria.	3½
Winona.	5½
Wolverine.	55
Wyandot.	1⅛

BOSTON CURB June 13	
Name of Comp.	
Bingham Mines.	13
Boston Ely.	.69
Boston & Mont.	2
Butte & Lon'n Dev.	.72
Calaveras.	4⅛
Calumet-Corbin.	.04½
Chief Con.	1 3/16
Cortez.	.40
Crown Reserve.	.50
Davis-Daly.	1 5/16
Eagle & Blue Bell.	2
Houghton Copper.	1½
Iron Cap Cop., pf.	6
Mexican Metals.	.33
Mojave Tungsten.	6⅛
Nat. Zinc & Lead.	2
Nevada-Douglas.	1 1/16
New Baltic.	2
New Cornelia.	13½
Ohio Copper.	.15
Oneco.	1
Raven Copper.	‡.18
Rex Cons.	.20
Rilla.	.85
United Verde Ext.	29½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January.	56.572	48.855	56.775	26.553	22.731	26.960
February.	57.506	48.477	56.755	26.573	22.753	26.975
March.	58.067	50.241	57.935	26.788	23.708	27.597
April.	58.519	50.250	64.415	26.958	23.709	30.662
May.	58.175	49.915	74.269	26.704	23.570	35.477
June.	56.471	49.034	.....	25.948	23.267	.....
July.	54.678	47.519	.....	25.219	22.597	.....
August.	54.344	47.163	.....	25.979	22.780	.....
September.	53.290	48.680	.....	24.260	23.591	.....
October.	50.654	49.385	.....	23.199	23.925	.....
November.	49.082	51.714	.....	22.703	25.094	.....
December.	49.375	54.971	.....	22.900	26.373	.....
Year.	54.811	49.684	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April.	16.811	27.895	75.096	124.319	*	137.389
May.	18.506	28.625	77.600	135.457	*	152.522
June.	19.477	.....	82.574	.....	95.333	.....
July.	18.796	.....	76.011	.....	91.409	.....
Aug.	16.941	.....	68.673	.....	82.333	.....
Sept.	17.502	.....	68.915	.....	85.250	.....
Oct.	17.686	.....	72.601	.....	88.000	.....
Nov.	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.43	.....
Year.	17.275	.....	72.532	.....	.....	.....

TIN

Month	New York		London	
	1915	1916	1915	1916
January.	34.260	41.825	156.550	175.548
February.	37.415	42.717	176.925	181.107
March.	48.426	50.741	180.141	193.609
April.	47.884	51.230	166.225	199.736
May.	38.790	49.125	162.675	196.511
June.	40.288	.....	167.636	.....
July.	37.423	.....	167.080	.....
August.	34.380	.....	151.440	.....
September.	33.125	.....	152.625	.....
October.	33.080	.....	151.554	.....
November.	39.224	.....	167.670	.....
December.	38.779	.....	167.000	.....
Av. year.	38.590	.....	163.960	.....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January.	3.729	5.921	3.548	5.826	18.606	31.167
February.	3.827	6.246	3.718	6.164	19.122	31.988
March.	4.053	7.136	3.997	7.375	21.883	34.440
April.	4.221	7.630	4.142	7.655	21.094	34.368
May.	4.274	7.463	4.182	7.332	20.347	32.967
June.	5.932	.....	5.836	.....	25.170	.....
July.	5.659	.....	5.531	.....	24.611	.....
August.	4.656	.....	4.520	.....	21.946	.....
September.	4.610	.....	4.490	.....	23.151	.....
October.	4.600	.....	4.499	.....	23.994	.....
November.	5.155	.....	5.078	.....	26.278	.....
December.	5.355	.....	5.266	.....	28.807	.....
Year.	4.673	.....	4.567	.....	22.917	.....

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April.	10.012	16.695	9 837	16.525	49.888	99.056
May.	14.781	14.276	14.610	14.106	68.100	94.2 7
June.	21.208	.....	21.038	.....	100.614	.....
July.	19.026	.....	18.856	.....	97.250	.....
Aug.	12.781	.....	12.611	.....	67.786	.....
Sept.	13.440	.....	13.270	.....	67.841	.....
Oct.	12.800	.....	12.596	.....	66.536	.....
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year.	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January.	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February.	14.55	21.16	13.45	18.93	13.90	19.51
March.	14.55	21.81	13.45	19.20	13.95	19.45
April.	14.55	21.65	13.45	18.95	13.95	19.45
May.	14.61	21.78	13.60	19.11	13.83	19.58
June.	14.70	.....	13.67	.....	13.77	.....
July.	14.94	.....	13.91	.....	13.68	.....
August.	16.01	.....	15.31	.....	14.75	.....
September.	16.86	.....	15.95	.....	15.70	.....
October.	16.95	.....	15.96	.....	15.80	.....
November.	17 57	.....	16.47	.....	17.20	.....
December.	19.97	.....	18.44	.....	18.95	.....
Year.	$15.82	.....	$14.76	.....	$14.95	.....

‡As reported by W. P. Snyder & Co.